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## TWO NEW SENECIOS FROM THE WEST INDIES<sup>1</sup>

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The botanical expeditions to various parts of the West Indies, which have been conducted under the auspices of the New York Botanical Garden during the past twenty years, have materially advanced our knowledge of the flora of that region in securing additional material of many little-known plants and in discovering a considerable number of species new to science. Among recent collections of the genus *Senecio* from the American tropics, which have been submitted to the writer for identification, two from the West Indies appear not to have been previously described. Descriptions of these plants are now placed on record, as follows:

### *Senecio subsquarrosus* Greenman, sp. nov.

Frutex .5-1 m. altus; ramis angulato-caniculatis dense tomentosis; foliis alternis petiolatis elliptico-oblongis vel subobovatis 5-8 cm. longis 1.5-3 cm. latis obtusis integris vel remote sinuato-dentatis plus minusve revolutisque ad basim cuneatis vel subrotundatis supra tomentulosi primo mox glabratis series glaberrimis, subtus dense et persistenter tomentosis; petiolis .5-1 cm. longis tomentosis; inflorescentiis terminalibus sessilibus crebre corymboso-cymosis; capitulis circiter 8 mm. altis discoideis calyculatis; squamellis calyculatis spathulatis 5-7 mm. longis subsquarrosis; involucri squamis 8 erectis lineari-lanceolatis obtusis 6 mm. longis extrinsecus dense tomentosis;

<sup>1</sup> Issued Jan. 9, 1922.

floribus 10-12; corollis infundibuliformibus flavibus; pappi setis albidis ad corollam subaequantibus; achaeniis hirtellis.

Shrub, .5-1 m. high; branches angulate-channelled, densely tomentose; leaves alternate, petiolate, elliptic-oblong to sub-obovate, 5-8 cm. long, 1.5-3 cm. broad, entire or remotely sinuate-dentate and more or less revolute, tomentulose above in the early stages, but soon glabrate, densely and persistently tomentose beneath; petioles .5-1 cm. long, tomentose; inflorescence a terminal sessile crowded corymbose cyme; heads about 8 mm. high, discoid, calyculate with spatulate 5-7 mm. long subsquarrose bracteoles; bracts of the involucre 8, erect, linear-lanceolate, obtuse, 6 mm. long, densely tomentose on the outer surface; flowers 10-12; corollas tubular-funnelform, yellow; setae of the pappus white, equalling the corolla; achenes hirtellous.—On wet rocks, Rio Guayabo, above the falls, Oriente, Cuba, alt. 450-550 m., 21-30 January, 1910, *J. A. Shafer 3722* (Gray Herb. and N. Y. Bot. Gard. Herb; photograph and fragment in Mo. Bot. Gard. Herb.), TYPE.

The relationship of this species appears to be with *S. carinatus* Greenm. from which it differs in having a crowded and very densely tomentose inflorescence, spatulate subsquarrose bracteoles, eight instead of five involucre bracts, and more numerous flowers in the head.

***Senecio Freemanii* Britton & Greenman, sp. nov.**

Caulis lignescens scandens usque ad 15 m. longus; ramis floriferis teretibus striatis brunneis glabris; foliis alternis petiolatis reflexis ovatis vel ovato-ellipticis 5-8 cm. longis 2.5-4 cm. latis acutis vel obtusis integris utrinque glabris subtus pallidioribus basi in petiolam abrupte contractis, margine plus minusve revolutis; petiolis 6-12 mm. longis; inflorescentiis axillaribus aut terminalibus cymosis parce fulvo-pilosulis paucicapitatis; capitulis 15-18 mm. altis homogamis; involucri anguste campanulatis parce calyculatis; involucri squamis plerumque 8 linearilanceolatis acutis 12-15 mm. longis 1.5-3 mm. latis glabris; floribus disci plerumque 18; pappi setis albis; achaeniis circiter 3 mm. longis striato-costatis glabris.

Stem ligneous, scandent, often 15 m. long; flowering branches terete, striate, brownish, glabrous; leaves alternate, petiolate,

reflexed, ovate or ovate-elliptic, 5-8 cm. long, 2.5-4 cm. broad, acute or obtuse, entire, glabrous on both surfaces, somewhat paler beneath, abruptly narrowed at the base into the petiole; margins more or less revolute; petioles 6-12 mm. long; inflorescence axillary or terminal, cymose, sparingly tawny, pilose, few-headed; heads 15-18 mm. high, homogamous; involucre narrowly campanulate, sparingly calyculate; bracts of the involucre usually 8, linear-lanceolate, acute, 12-15 mm. long, 1.5-3 mm. broad, glabrous; disk-flowers usually 18; setae of the pappus white; achenes about 3 mm. long, striate-ribbed, glabrous.—In forest near summit of Mount Tucuche, Trinidad, British West Indies, April 3-5, 1920, *N. L. Britton, T. E. Hazen & Walter Mendelson 1292* (N. Y. Bot. Gard. Herb.; photograph and fragment in Mo. Bot. Gard. Herb.), TYPE.

This species is most nearly related to *Senecio Hollickii* Britton, from which it differs in having larger heads, longer involucre bracts, and glabrous instead of pilose achenes. It is named in honor of Mr. W. G. FREEMAN, Director of Agriculture in Trinidad.

## EXPLANATION OF PLATE

## PLATE 1

*Senecio subsquarrosus* Greenman

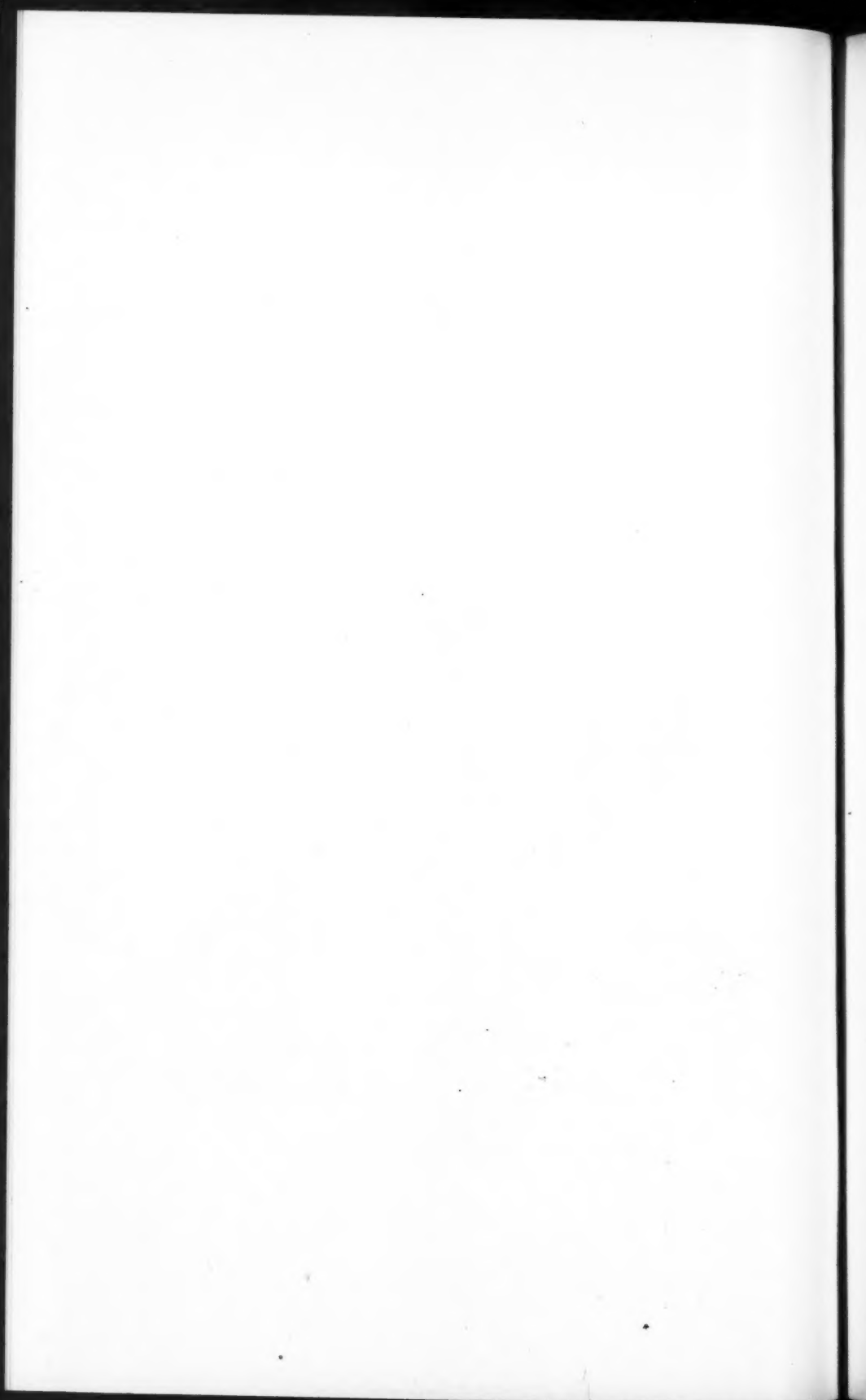
Cuba

From Shafer No. 3722 in Gray Herbarium  
of Harvard University.





GREENMAN—WEST INDIAN SENECIOS





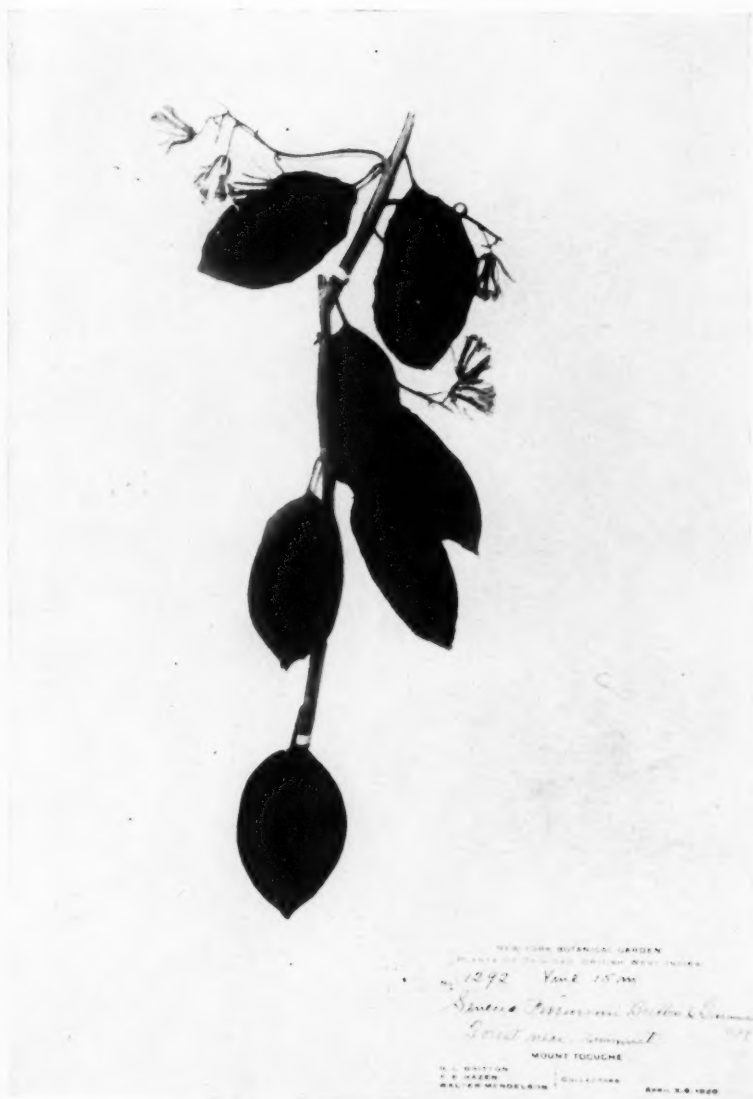
## EXPLANATION OF PLATE

## PLATE 2

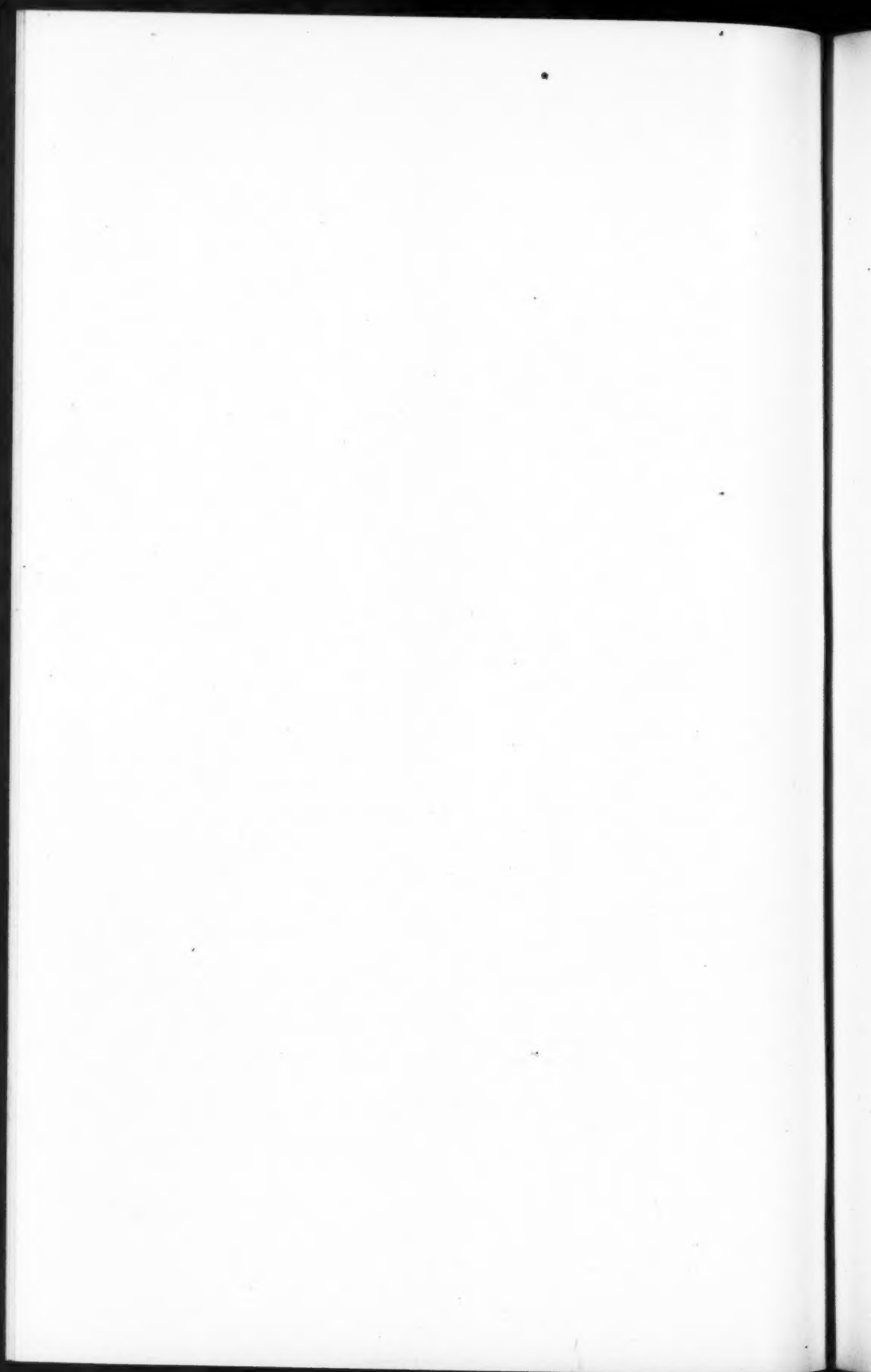
*Senecio Freemantii* Britton & Greenman

Trinidad

From Britton, Hazen & Mendelson No. 1292  
in New York Botanical Garden Herbarium.



GREENMAN—WEST INDIAN SENECIOS



# A MONOGRAPH OF THE GENUS LESQUERELLA<sup>1</sup>

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## GENERAL MORPHOLOGY AND PHYLOGENY

The *Cruciferae* are especially interesting from a phylogenetic point of view because of the importance that attaches to what seem to be minute characters. The greatest students of the subject have failed to find many points of agreement, and there is much confusion in regard to even the broad lines of relationship within the family. It is, of course, a most homogeneous group, and the same variations have occurred independently time and again, thus giving rise to similar forms that are not of necessity analogous. It becomes increasingly evident that before any satisfactory grouping within the family can be made every genus must be studied critically and its connections traced to other genera. It is of fundamental importance to know which species within a group are the primitive ones and which represent terminal branches. When much reliable data of relationship within small groups have been accumulated, and only then, may the parts be finally pieced together, unless perhaps too many intermediates have been irrevocably lost. From present indications, however, an optimistic view may be held with regard to the final solution. In the following treatment of the genus under consideration there have been assembled in paragraphs dealing with particular organs or tissues the various phylogenetic conclusions arrived at and some of the arguments in favor of the different hypotheses. These conclusions, it is believed, point the direction of development in the genus *Lesquerella*, but are not necessarily to be relied upon for any other genus.

*Habit of Growth.*—There are within the genus a few species entirely herbaceous and, under any but the most favorable conditions, certainly annual. Several others have attained an extreme annual condition and pass most of their life within the

<sup>1</sup> Issued Jan. 14, 1922.

protection of the seed. The great majority, however, are definitely perennial and some of these develop a considerable amount of woody tissue in their caudices. The eleven species which constitute the first group are further characterized by branching stems, of which one is formed by the original terminal bud. An extreme development of the annual habit is certainly a definite step in the direction of specialization, although probably a step of no great difficulty. Three species seem to belong to this group of extreme annuals, namely, *L. recurvata*, *L. aurea*, and *L. Palmeri*, and are placed higher in the scale of development than the first group. In these three species the stems are often branched but there is a distinct tendency to an unbranched condition; the terminal bud develops normally. The third category, those species which are definitely perennial, includes some thirty-seven species in varying degrees of development. The extreme development in this group is reached in certain arctic and alpine plants of which *L. arctica* and *L. diversifolia* are examples.

The rosette habit, in which the terminal bud remains undeveloped and lateral stems arise from among the basal leaves, is characteristic of some thirty-three species. In many of these the rosette is strikingly symmetrical and approaches closely to the condition found in certain species of *Physaria*. Some intermediate steps in the formation of rosettes are of particular interest and indicate that the rosette may have arisen in several ways. In a few species, notably *L. Engelmannii*, the terminal bud produces a short, sterile shoot. In *L. lata* and *L. pinetorum* the terminal bud gives rise to a short, fertile shoot that is floriferous nearly or quite to the base, in contrast to the longer lateral stems that bear an inflorescence above their numerous leaves. In *L. intermedia* and *L. arizonica* the terminal bud may give rise either to a normal fertile stem or may be completely inhibited. Branching stems are comparatively rare among the perennial species.

At the top of a list in which the species are arranged in an order of merit based on specialization in the habit of growth is placed *L. Cusickii*. This plant is an annual or short-lived perennial which has evidently been derived from truly perennial



species. In it the rosette is fully developed. Not because of any arguments to be derived from the condition of the roots themselves, have the present phylogenetic conclusions been reached, but because of the correlation with these habits of various other characters that seem clearly to point the direction of the current. The appearance of the rosette habit among the perennials, a character that is clearly derived from the normal condition found in the annual species, is one argument in favor of the present hypothesis that the ancestor of this genus was quite devoid of woody tissue and if not a true annual, was at least entirely herbaceous.

*Shape of the Leaves.*—In the form of the leaves, and particularly of the radical leaves, are to be found some of the most convincing bits of evidence that point the direction in which evolution has occurred. Pinnate, and especially lyrate-pinnatifid, leaves are common throughout the *Cruciferae*, and for this reason alone one would be inclined to consider those species bearing this type of leaf as more primitive than those with entire leaves. It is among the annual species that the pinnate leaf finds its best development, and, indeed, there are none of the purely herbaceous species, except *L. Cusickii*, that do not exhibit this tendency to a more or less marked degree. On the other hand, in only three or four perennial species is the lobing of the radical leaves at all conspicuous. The change from one type to another is very gradual, and the same species may sometimes have entire and sometimes lyrate leaves. Two distinct tendencies are noted: either the leaf may become narrower until a truly linear form is attained, as in the *alpina* group, or it may become broader and the blade abruptly, rather than gradually, narrowed to the petiole. Four species in the genus have cauline leaves that are definitely auriculate at the base and conspicuously toothed. These four species are distributed within the three sections, are all annuals, and all have pinnate basal leaves. Such a condition is believed to represent the ancestral type, and from it to have been derived linear or suborbicular radical leaves and oblanceolate or linear cauline leaves with a narrow base.

*The Flowers.*—In this, as in most other genera of the family, there are few differences in flower parts that offer characters of taxonomic value or help to solve the intricacies of phylogeny.

Because these structures are relatively stable the few differences they do present are often of great value in determining larger circles of relationship and as such are of unusual interest. The sepals are of two nearly equal pairs. They are never truly saccate at the base and are always pubescent with trichomes similar to those borne on other parts of the plant. The petals vary from obovate to narrowly spatulate. They are always entire and there is no distinct differentiation between blade and claw. The broader form is prevalent among the annual species with pinnatifid leaves and presumably represents the original type more closely than the narrow form that is common among the perennial, rosette-forming members of the genus.

The petals are usually yellow and this is undoubtedly to be regarded as the primitive color. In a few species it is pale and variously tinged with red or purple, as in *L. pallida*, *L. purpurea*, and *L. pueblensis*. A more common departure from the normal is found in a number of the more recent forms of widely different groups in which the yellow gives place to a red pigment. This red color may be present only on the tips of the petals as a narrow border or may extend nearly to the base. In some species it apparently appears as the flowers wither. Always its presence or absence is to be regarded as of little significance in the determination of specific limits. This variation has been noted in *L. argyrea*, *L. Fendleri*, *L. Berlandieri*, *L. arenosa*, *L. cinerea*, *L. Kingii* and *L. utahensis* and probably occurs in many others. It is of interest to note here that a similar color change occurs in some species of the related genus *Physaria*.

The staminal filaments present a single character of considerable significance: a conspicuous broadening or dilation at the base, which in its extreme is quite abrupt. Of the six species that show this dilation in a considerable degree, one, *L. Lescurii*, occurs in the section *Alysmus*, one, *L. lasiocarpa*, in *Enantiocarpa*, and four, *L. auriculata*, *L. grandiflora*, *L. densiflora* and *L. angustifolia* in *Eulesquerella*. The four species possessing auriculate cauline leaves, previously considered as most primitive, also possess filaments with dilated bases. The remaining two are primitive in many respects and have certainly not been derived from any more primitive species now existent. All six are annuals and in all six the terminal bud is uninhibited. There

seems no other alternative than to consider this broadened condition of the filament as another character possessed by the ancestral type of the genus.

*The Nectar Glands.*—European botanists have for many years been discussing the taxonomic merits of a study of the nectar glands in the *Cruciferae*, with quite diverse resulting opinions. Much yet remains to be done before their value may be estimated satisfactorily, but it is certain that they must not be neglected in any work, particularly in groups above generic rank, that seeks to unravel natural relationships. Because of the small size and lack of distinguishing color, the difficulty attendant upon their investigation prevents their use in diagnoses or keys intended for popular use and greatly hinders their investigation by the specialist. The degree to which they are developed varies considerably between species and also apparently between individuals, but within the genus the general plan of their arrangement remains fairly constant. These glands consist of elevations of secretive tissue on the receptacle near the bases of the stamens. In *Lesquerella* the greatest development occurs in the immediate vicinity of the base of the solitary stamen and from here extensions reach toward the bases of the double stamens, as shown in the diagrammatic sketch of the location of the glands in *L.*



Fig. 1. Diagram showing relative position of nectar glands and stamens in *L. auriculata*.

*auriculata* (fig. 1). Occasionally there is a considerable growth of glandular tissue below or between the double stamens. Sometimes the ring surrounding the solitary stamen may be unbroken on either side or may be open on the opposite side from that shown in the diagram. The glands may be rounded elevations, ridge-like or plate-like masses in different species, or they may be even produced into short, horn-like processes as in *L. lasiocarpa*. In general, the greatest glandular development is to be found in the more primitive species, and probably the glands of the group from which *Lesquerella* was derived were not unlike those of *L. auriculata*.

*The Pedicels.*—Considerable importance attaches to the form of the pedicels in the determination of species because of three characteristic and relatively constant positions assumed. The

first of these is described in the diagnoses as "straight or simply curved upwards" and is to be seen in such species as *L. auriculata*, *L. Engelmannii*, *L. arctica*, *L. globosa*, and *L. Fendleri*. The second type is that known as "recurved." This again is a simple curve and differs from the first in direction and usually in degree: *L. lasiocarpa*, *L. purpurea*, *L. recurvata*, and *L. argentea* serve as illustrations. The third type obtains to some extent in the great majority of species. The curve in this case is a compound one resembling the letter S reversed and lying on its side, and consequently has been termed "sigmoid" or "S-shaped." Species characterized by the third type of pedicel usually have erect pods since the final or distal curve is directed upwards. In general, these three types are easily recognizable but occasionally forms of the sigmoid group are observed in which the final curve has become so nearly obsolete that the pedicel is practically recurved. However, in such cases there is usually at least a suggestion of the final curve in part of the inflorescence and this is enough to indicate the normal condition, since no such tendency is found in any of the species with constantly recurved pedicels. Not a great deal of stress is placed upon the form taken by the pedicel in indicating actual relationships. The first type may be considered primitive since it is characteristic of the family in general and of most of the more primitive species in the genus. The recurved pedicel has probably been developed independently at least three times within the genus, though there is no indication that it has arisen from any except the first type, and from that it is, after all, but a minor change. There is, of course, the possibility that species with recurved pedicels included in sigmoid groups have passed through the stage characteristic of those groups and have subsequently lost the final upward curve—*L. purpurea* and *L. pueblensis* may have had this history. The sigmoid condition is surely a mark of greater specialization than either of the other two, although the change is relatively a simple one. It has probably been derived entirely from the first type and seems to have developed independently at least three and possibly more times. It is noted in such diverse species as *L. Schaueriana* of the section *Enantiocarpa* and *L. argyraea*, *L. alpina*, *L. montana* and *L. Kingii* of *Eulesquerella*.

*The Capsules.*—Of all the various parts of cruciferous plants that are of interest to the taxonomist, the first place is held by the capsules, or pods, since in their component parts occur much greater differentiations than in the more uniform flowers or more readily modified leaves. *Lesquerella* is no exception to this rule, for although we may base theoretical conclusions on the variations assumed by other parts of the plants these conclusions are quite worthless if they do not correlate with those derived from a study of the fruits. Were it not for certain similarities in the structure of the capsules the genus would be incapable of maintenance in its present form and the relationship that is now so evident would become obscure. In order to analyze the various changes that have occurred and to trace their development, the component parts of the fruit will be considered separately and in different paragraphs.

*The Gynophore.*—The gynophore, or stipe that raises the pod above the torus in some species, is a character of considerable importance taxonomically and of great interest from the viewpoint of phylogeny. It is of the more interest because its significance at present is not at all certain. It is present to a noticeable degree in at least five species and reaches its greatest development in the two most primitive of these, *L. Lindheimeri* and *L. gracilis*, in which it is often quite two millimeters long. In the other three, *L. Gordonii*, *L. Garrettii* and *L. latifolia*, though shorter, it is yet quite evident. In some other species, although the stipe is scarcely measurable, the pods are seen to be not truly sessile. *L. Gordonii*, which was undoubtedly derived from *L. gracilis* or a closely related form, is in several ways a step higher in the scale of development and has a reduced stipe. In *L. Palmeri*, which is a western offshoot of *L. Gordonii*, the stipe has disappeared completely. The other two species characterized by the possession of a distinct stipe are not closely related and have their nearest relatives in species with sessile pods. In their cases at least, the stipe is evidently an individual and perhaps an atavistic variation.

Because the most primitive species that show a distinct gynophore have it in its greatest development, and in more recent species it has gradually disappeared, the possibility is suggested that this character was present in the ancestral form of the genus.



This hypothesis seems to be strengthened by the reflection that the stipe is possibly to be considered a primitive character for the family received from Capparidaceous ancestors. The admission of the stipe to the hypothetical ancestor of *Lesquerella* would be very significant and might serve to ally the genus to the *Stanleya-Thelypodium* group, a possibility that should not be forgotten. While it seems well established that the species in which a long stipe is present are to be considered, among living species at least, more primitive than those having a shorter stipe, yet it is also evident that in the most primitive species of the genus the pods are quite sessile. At present, then, we are inclined to believe that the gynophore is a character of no great antiquity in *Lesquerella* and appeared perhaps in a single generation. This view is strengthened by the presence of the stipe in *L. Garrettii* and *L. latifolia* in groups whose ancestors must have had sessile pods and also by the occasional appearance of forms of *L. gracilis* with sessile pods throughout the range of this species.

*The Valves.*—The characteristic form of the pods is largely determined by the size and shape of the two opposing valves. In *Lesquerella* these valves at maturity are dehiscent from the frame-work or replum that bears the placentae and style and across which is stretched the delicate false partition or septum. The valves are rarely, if ever, more than twice as long as wide, are usually more or less inflated or cup-shaped, and are typically without a noticeable midrib. The division into sections is based upon the character of these valves and under the various sections, in a later paragraph, is given the characteristics of each. For the present we will content ourselves with a discussion of the changes that occur in the section *Eulesquerella*, since here are gathered all but four species of the genus. In this section the valves vary considerably between different species by the presence or absence of the stellate trichomes. They vary also in form; some are hemispherical, some lengthened and boat-shaped, some semi-ovoid and one curious form, *L. gracilis* var. *repanda*, bears a shoulder near the base and has an enlarged apex, consequently being obpyriform in outline. Although typically inflated many species possess pods that are variously compressed. Most frequently this compression is at the apex

or on the margins of the septum, and whenever it occurs it is of value to the taxonomist because of its constancy within specific limits. One would scarcely be justified for assuming on any *a priori* grounds that any one form represented the primitive type from which the others have been derived, and it is with great interest that we notice the spherical, glabrous pods of all the species of this section which, because of habit and leaf outline, we have already considered as primitive. In fact, to consider the glabrous, spherical pods as representing the original condition, and the variously elongated and compressed pods that are also almost without exception pubescent, as derived, is quite in harmony with all evidence gained from a study of the variation of parts about whose course of development there can be little doubt.

*The Septum.*—When Watson proposed the genus *Lesquerella* he emphasized the characters of the septum as distinguishing these plants from the Old-World group, *Vesicaria*. Subsequent observation has strengthened the importance of these characters in limiting the genus. Although there is considerable variation between species and even between individuals in the shape of the cells or "areolae" of the septum, there are several points that all the species possess in common. Of first importance, perhaps, is the "nerve," or line that extends from the apex to near the center of the septum. The presence of this nerve is by no means peculiar to *Lesquerella* but serves to separate it from those genera with which it is most likely to be confused. Second, probably, is to be mentioned the attachment of the funiculi to the septum for at least part of their lengths. In some species the attachment is only near the base, while in others the funiculi are attached for over three-fourths their lengths. In all species the attachment is evident upon careful dissection. Here again the character is not peculiar to the present genus but apparently occurs in relatively few genera.

Finally may be mentioned the shape of the cells of the septum. These vary from polygonal to tortuous, but in all the species the boundaries of the cells are distinct and not obscured by numerous lines that would form an anastomosing net-work over the surface. Neither are there present those superimposed fibers characteristic of some groups nor is the effect of numerous par-

allel lines ever produced. The septum is usually entire, but in a number of more highly specialized species is frequently perforate. This character is so variable between species that it seems impossible of use in their delimitation. No attempt has been made to draw phylogenetic conclusions from the characters of the septum, since no definite progression from one species to another has been discovered (fig. 2).

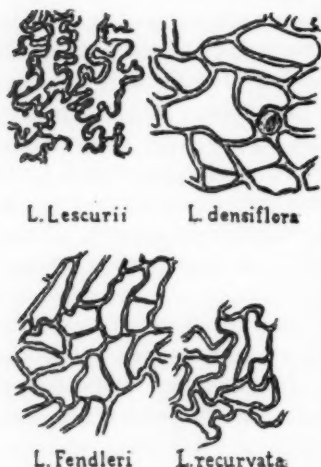


Fig. 2. Characteristic variation of septum between species of *Lesquerella*.

*The Number of Ovules.*—Reduction in the number of ovules within the ovary is so constantly coincident with specialization among dicotyledons in general and in the *Cruciferae* in particular that before examining the species of a given genus one may confidently expect, if any intraspecific variation in the number of ovules occurs, to obtain evidence as to what are the more primitive and

what the more recent forms. In the present genus the number of ovules varies between two and sixteen in each cell. While in very few species is the number constant, it varies for a given species within certain limits. It must not be forgotten that the data obtained for the present study were from herbarium material only, and as this was often rather scanty the maxima and minima given are not necessarily exact. It is believed, however, that the relative position of but few species in regard to the number of ovules would be materially changed by increasing the known range of variation. Of particular significance is it to compare pairs of species that are very closely related and of which one has probably been derived from the other. *L. argyraea* and *L. Berlandieri* furnish one interesting case. The former has glabrous pods and the latter stellate-pubescent ones. The former has eight to sixteen ovules and the



latter four to seven. *L. Gordonii* has glabrous pods with four to ten ovules and *L. Palmeri* pubescent pods with four to six ovules. Two species from among the most primitive in the genus in many respects are *L. auriculata* and *L. grandiflora*. The former has a number of long, simple trichomes intermixed with the branching or stellate hairs, has abruptly dilated filament bases, and six to eight ovules; the latter has lost most, if not all, of the simple trichomes, has gradually dilated filament bases, and four to six ovules. A series of three species probably to be placed in linear sequence is that formed by *L. intermedia*, *L. alpina*, and *L. condensata*. The first shows only partial inhibition of the terminal bud, noncompressed pods, and three to eight ovules; the second shows complete inhibition of the terminal bud, pods that are compressed at the apex, and two to four ovules; the third, besides having a terminal bud that remains undeveloped and a pod compressed at the apex, also has greatly reduced stems, and but two ovules. *L. angustifolia* is of particular interest because it has retained so many primitive characters but has only two ovules in each cell.

After considering these facts and many other similar ones it has been felt that above all else the relative number of ovules possessed by any species is indicative of its position in a series. No case is known in which one species, thought because of other characters to have been derived from another, has a greater number of ovules than the supposed parent. A given species may have the largest number of ovules in the genus but on that account has not of necessity the greatest number of primitive characters nor is it to be thought the ancestor of all forms with fewer ovules. All that is indicated is that this species with numerous ovules is more primitive than species closely related to it and having fewer ovules. Furthermore, the species having the most ovules could not have been derived from any other species now extant. *L. argyrea* will serve to illustrate this line of reasoning. It possesses more ovules than any other species of *Eulesquerella* and is held to be the most primitive species extant of its own particular branch, yet it has lost many characters we believe the ancestral form to have possessed and which are retained by many species with fewer ovules than *L. argyrea*. At every point, conclusions derived from other sources have

been confirmed by a comparative survey of the ovule number in the species concerned.

*The Seeds.*—In this genus the seeds offer little of diagnostic value. Four species have definitely winged or margined seeds. These species are the same that have been previously mentioned as having auriculate stem-leaves and they belong to the three sections. They have already been designated as possessing more primitive characters than any other four species, and consequently this seed character is probably to be considered most primitive also. Throughout the genus the relative position of the cotyledons and the radical is nearly constant and is described by the adjective "accumbent." In this case the radical is applied to the edge rather than to the back of the cotyledons and in cross-section may be diagrammatically represented thus:  $\circ =$ . In perhaps six species the radical is not centrally placed but twisted slightly to one side and the cotyledon on that side is slightly shorter than on the other. This condition is considered derived, since it occurs in widely diverse and evidently terminal species.

*The Trichomes.*—In the past, attention enough has been paid to the character of the trichomes in cruciferous plants to make it imperative that they be considered critically in any study in any group of species of this family. Many taxonomists have segregated genera largely on the character of the trichomes and some have gone so far as to distinguish tribes by the simple or branched hairs. In *Lesquerella* the species are more or less densely clothed with variously branching hairs which in many cases give them a silvery gray color. Simple trichomes occur regularly in but three species, and in these they are not numerous nor conspicuous and must be searched for with the lens; in a fourth they may be found occasionally. These four species are the same as have been mentioned several times as most primitive and are further characterized by auriculate stem-leaves, winged seeds, and filaments with dilated bases. In these species the branched hairs are frequently not truly stellate by reason of the central ascending axis with branches produced at several heights. Even in the truly stellate hairs the branches are few and always distinct. In the variation of the trichomes in any of the three first-mentioned species, *L. Lescurii*, *L. lasio-*

*carpa*, or *L. auriculata*, may be traced the manner of evolution from a simple hair to a few-rayed, stellate hair. That the simple or few-branched hair is the more primitive form there can scarcely be a doubt, and if there were it would be dispelled by correlating the relative increase in number of rays with the advance of other specializations. In the great majority of species the stellae are nearly symmetrical and the rays are rather conspicuously forked above the base. In the more primitive forms the rays are few and distinct and as progression occurs they become more numerous and are often more or less regularly or irregularly united. Frequently the stellae are conspicuously granular, particularly near the center, with accumulations of lime, but the degree to which these granules are developed and the exact number of the rays vary greatly within the species.

There are two deviations from the normal type of trichome structure. The first of these concerns *L. densiflora* and *L. Engelmannii*, but is more easily observed in the former than in the latter. Its peculiarity consists in a deeper U-shaped notch on one side that renders the stellae somewhat unsymmetrical. This notch is quite universally directed toward the base of the stem or the leaf which would suggest that the stimulus for its development had some connection with gravitational force. Curiously enough even on horizontal stems this notch parallels the axis of the stem and so in this case the notch is at right angles to the pull of gravity. However, this would be explained if these horizontal stems were erect during the period of trichome formation. *L. Engelmannii* possesses this characteristic to a less striking degree, as has already been remarked, and this is due in large part to the more numerous rays which in a measure "crowd out" the notch. These two species, with *L. ovalifolia*, form an interesting series of gradually increasing specialization. In *L. ovalifolia* the stellae are quite symmetrical and the notch has disappeared. The rays are also decidedly more numerous than in *L. Engelmannii*. The second departure from the usual type of stellate trichome unites the six members of the *argyraea* group. Here the rays are described as unbranched, and if they are forked, the forking occurs so near the center of the stars as to render it inconspicuous. The resulting characteristic form is easily distinguished from the more common type by referring to the dia-

grams. The species so segregated are certainly not to be arranged in a linear series but it is believed that they are historically united by some common ancestor. In *L. Schaffneri* of this group the greatest degree of union possible occurs between the rays and a radiately marked scale is produced.

*Summary.*—The more important phylogenetic conclusions reached in the preceding paragraphs may be summed up as follows:

1. The immediate ancestors of this genus are believed to have been entirely herbaceous.
2. Rosette-forming species in which the terminal bud remains comparatively undeveloped are held to have been rather recently derived from species in which there is no inhibition of the terminal bud.
3. From the lyrate-pinnatifid type of radical leaves have been evolved the entire linear or suborbicular leaves.
4. Cauline leaves with auriculate bases are considered more primitive than those which are narrowed to the base.
5. Yellow is the predominating petal color in primitive species, while white, red, or purple is of more recent origin. The obovate petal is more primitive than the narrower forms.
6. The species of *Lesquerella* having abruptly dilated filament-bases are to be considered more primitive in this character than those with gradually dilated or linear filaments.
7. Within the genus there is not a great deal of variation in the nectar glands, but the tendency seems to be toward reduction.
8. The recurved or S-shaped pedicels are thought to have been developed from straight or curved-ascending forms.
9. The length of the gynophore or stipe, when present, seems to decrease with further development, yet it may not have been present in the ancestor of this genus.
10. Glabrous, spherical capsules are considered primitive, at least in the section *Eulesquerella*.
11. The course of evolution has been in every case from the many- to the few-ovuled forms.
12. Seeds provided with a narrow wing or margin are believed to have prevailed among the most primitive species. In a few

recent forms the cotyledons are not quite symmetrical and the radical is slightly turned to one side.

13. Simple or branched trichomes are believed to have given rise to few-rayed and finally to many-rayed stellae.

#### SECTIONAL AND SUBSECTIONAL GROUPS

An endeavor has been made to reconstruct the phylogenetic tree of *Lesquerella* from a knowledge of the tips of the branches with the aid of certain conclusions reached in previous paragraphs as to the trend of evolution (fig. 3). Such reconstructions are necessarily subject to many sources of error, but if they serve no other purpose than to present in a graphic way the author's conclusions, be they correct or not, they are worth while. Only the three main branches have been given definite systematic rank as sections and have been introduced into the taxonomic treatment. The smaller branches have been informally termed "groups" and have been emphasized in no other way than by associating allied species together in the systematic arrangement.

*The Sections.*—It is believed that there were three lines of divergence from some ancient stock. These three primary branches have extant one, three, and forty-eight species respectively, and each branch has been given sectional rank. In habit and majority of vegetative characters the most primitive species of each of these three sections are very similar. Only in the shape of the pods is there any considerable difference. In the first section, *Alysmus*, these are circular and strongly flattened parallel to the septum; in the second, *Enantiocarpa*, the outline of the pods in the most primitive species is also circular but compressed at right angles to the partition; and in the third, *Eulesquerella*, the pods are spherical and in the more ancient species no flattening occurs in either plane. Because from this last, or third, type the two others could have been more easily derived than the second or third type could have been developed from the first, or more easily than the first and third from the second, and because the third type has produced such an immensely greater number of species, it, that is, *Eulesquerella*, is thought to represent the ancient trunk more nearly than do the other two. Members of the first and second sections have been at some





time referred to other genera, but, while they represent natural groups, their interrelationship seems so evident that it appears much the wiser course to unite them under one name.

The first section, as previously stated, contains but a single species, *L. Lescurii*. To the second are referred but three, and one of these, *L. frigida*, has not been seen. The other two, *L. lasiocarpa* and *L. Schaueriana*, although united by the strongly obcompressed pods, show few characters in common. Probably intermediate species may ultimately be reported from the unexplored regions of Mexico. It is the third section, *Eulesquerella*, in which we are particularly interested because here occurs the great mass of species and because many intermediate steps are found between primitive and recent forms.

*The Subsectional Groups.*—The aim has been to bring together into these groups the species that are closely allied. They represent, in a measure, the visible twigs of the phylogenetic tree, although between the units there are frequent gaps of considerable extent. These groups, in some cases at least, may correspond to the "major species" of Hall and Clements.

1. The *auriculata* group contains but two species, *L. auriculata* and *L. grandiflora*, and of these the first is the more primitive. Auriculate stem-leaves, annual roots, dilated filament-bases, and glabrous pods are their chief characteristics.

2. The *Engelmannii* group has been made to include three species, *L. densiflora*, *L. Engelmannii*, and *L. ovalifolia*. The one unusual feature that they possess in common is a contracted and often subumbellate fruiting inflorescence. That the group is a natural one there can be no doubt. Because of the contracted inflorescence the first and second species might seem to be associated, but this could not be certain were it not for the slight asymmetry in the stellae which both exhibit. As has been previously mentioned, this consists in a deeper U-shaped notch on one side of the otherwise symmetrical trichome. Such a peculiarity, it is believed, could scarcely have arisen twice in the same genus. *L. ovalifolia* is a rather recent segregate from *L. Engelmannii* and their affinity is very close, although the U-shaped notch has disappeared in the former. The three species may be placed in linear sequence, each having been derived from the one preceding. Whatever intermediates there might have

been have since disappeared. Besides other advances mentioned elsewhere this group shows a change from sparingly lyrate leaves in *L. densiflora* to entire, oblanceolate leaves in *L. Engelmannii* and finally to entire, ovate leaves in *L. ovalifolia*. Because the pods in this group are not always quite sessile it may possibly have been derived from the *gracilis* group.

3. *L. montevidensis*, although insufficiently known, has an aspect similar to *L. Engelmannii* and may be related to the preceding group.

4. *L. arctica*, with its variety *Purshii*, shows no very close relationship to any other species and is thought to have arisen from some primitive species now unknown. Because of an apparent decrease in the number of ovules and the more frequent appearance of scattered stellae on the pods, the variety is thought to have been derived from the species.

5. The *argyreae* group, previously mentioned as having the rays of the stellae unbranched, contains six species, *L. argyreae*, *L. Berlandieri*, *L. purpurea*, *L. Fendleri*, *L. Schaffneri* and *L. pueblensis*. In this group the second alone possesses pubescent pods but in other ways it is not so specialized as some of the related species. It has probably been directly derived from *L. argyreae*. The other species may have had a common ancestor more primitive even than *L. argyreae*. This was certainly the case with *L. Fendleri*. *L. purpurea* and *L. pueblensis*, although distinguished from the others of this group by their recurved pedicels, are not on this account thought to be closely related. Each of the species in the group stands apart from the others as a distinct unit.

6. The *recurvata* group also includes six species, *L. recurvata*, *L. pallida*, *L. aurea*, *L. argentea*, *L. arenosa*, and *L. macrocarpa*. All these species possess recurved pedicels, stellae with forked rays, and globose pods that are either glabrous or pubescent. *L. pallida* and *L. aurea* seem to represent terminal groups derived from *L. recurvata*. Like it they are annuals. *L. aurea* is of particular interest because the reduction in the number of ovules is extreme and the capsules are either glabrous or stellate-pubescent. *L. argentea*, *L. arenosa*, and *L. macrocarpa* are perennials with densely pubescent pods. *L. argentea*, it is believed, has been derived from *L. recurvata*, although in some respects *L.*



*arenosa* is more similar than *L. argentea* to the primitive form. There can be little doubt that *L. macrocarpa* is a recent offshoot from *L. argentea*. The reduction of its ovules to two confirms this belief. Within this group we see a change from annual to perennial habit occurring associated with a reduction in the number of ovules as well as the appearance of trichomes on the pods. There also occurs the change from sparingly pinnatifid leaves in *L. recurvata* to entire, suborbicular leaves in *L. macrocarpa*.

7. *L. angustifolia*, like *L. arctica*, is a species without close relatives. The glabrous pods and abruptly dilated filament-bases mark it as primitive. The reduction of the number of ovules to two is suggestive of a longer evolutionary history.

8. The *gracilis* group is characterized by the possession of a gynophore in the three primitive species, by sigmoid pedicels in all but *L. gracilis* itself, and by glabrous pods except in *L. Palmeri*. This group is of particular interest on account of the diversity of form between the units involved and because three of the species may be thought to represent three specific generations. *L. Lindheimeri*, although inadequately known, may be regarded as the most primitive of the four species in the group because of the deeply pinnatifid leaves. The other three species, *L. gracilis*, *L. Gordonii*, and *L. Palmeri*, serve to illustrate the shortening of the gynophore as specialization increases. The number of ovules also decreases step by step, and in *L. Palmeri*, in which this reduction reaches the average number of five, the gynophore has disappeared completely and the pods have become pubescent. The variety *repanda* of *gracilis* shows the appearance of a unique character in the genus—the shoulder at the base of the pods. It is not improbable that most of the succeeding groups have developed from this one.

9. The *pinetorum* group consists of but two species, *L. pinetorum* and *L. pruinosa*. They are the only perennials with glabrous pods, sigmoid pedicels, and stellae with branched rays. The first shows only a partial inhibition of the terminal bud, globose pods, and radical leaves that are gradually narrowed at the base. In the second the inhibition of the terminal bud has become complete, the pod elongated, the basal leaves abruptly narrowed to the petiole, and the number of ovules reduced.

10. The *montana* group, consisting of *L. lata*, *L. rectipes*, *L. montana*, and *L. curvipes*, is, in its most primitive representative, very close to *L. pinetorum* of the preceding group. The only character distinguishing all the species of this group from all of the preceding is the pubescent pods. *L. lata*, like *L. pinetorum*, shows only a partial inhibition of the terminal bud. In all the other species this inhibition is complete. *L. rectipes* and *L. montana* may both have developed from *L. lata*. *L. curvipes* is certainly an offshoot of *L. montana*. The transition from globose to elongated pods with a compressed apex is seen in this group.

11. *L. globosa* is another solitary species derived perhaps from some very ancient form.

12. The affinity of *L. mendocina* remains obscure. Although it has reached a stage of development equivalent to *L. montana*, there is no evidence that they are closely related.

13. The *alpina* group is a homogeneous assemblage of closely related forms characterized by narrow leaves. In the two most primitive of these, *L. intermedia* and *L. arizonica*, the inhibition of the terminal bud varies greatly within the species. *L. alpina* has probably been developed from *L. intermedia* and it in turn has given rise to *L. condensata*. In both these species the inhibition of the terminal bud is complete. The gradual reduction in the number of ovules in the species of this group has been mentioned elsewhere. The appearance of a terminal compression of the pods in *L. alpina* is passed on to *L. condensata*. The origin of *L. Garretii* is in doubt. Possibly it is an offshoot from *L. intermedia*. *L. valida* has not been seen but seems to be a primitive member of this group. Possibly it is but a form of *L. intermedia*.

14. The *utahensis* group, consisting of *L. cinerea*, *L. Kingii*, *L. latifolia*, *L. Wardii*, *L. utahensis* and *L. prostrata*, is taxonomically the most perplexing group of all. This is due in part to lack of adequate material and in part to a variability of the species concerned. There are within the group no evident lines of development. Rather this seems to represent a plexus of evolution, where the units, be they considered species, races, forms, or varieties of a great polymorphic species, are in a state of change. The group as a whole is characterized by the dense

rosettes, the suborbicular basal leaves, the short stems, and the pubescent, globose, or obcompressed pods. Our interest centers chiefly in *L. utahensis* because it is believed that from it or from some similar form has been developed the genus *Physaria*. Indeed the pods of some individuals of *L. utahensis* suggest that genus almost as much as they do *Lesquerella*.

15. The *occidentalis* group contains the remaining species of the genus, *L. diversifolia*, *L. occidentalis*, *L. Cusickii*, and *L. Douglasii*. The first three of these might be regarded as a single species in a more conservative treatment. They are peculiar because of the compressed margins of the pods. The first named is presumably the most primitive, though not necessarily so. Certainly *L. Cusickii* has been derived from one or the other. *L. Douglasii* does not exhibit the compression of the capsules and has possibly, though not probably, had a separate origin. It, as well as the other three, seems to have been derived from the *utahensis* group.

#### GEOGRAPHICAL DISTRIBUTION

It is believed that in geographical distribution is to be found a most valuable check to any theories of phylogeny derived from purely morphological studies. Furthermore, distribution is an important aid in deciding the relative value of variations for taxonomic purposes. For instance, it is often difficult to decide if a given form merits taxonomic recognition. In the present work the attitude has been taken that if such a form occurs in company with the normal form throughout its area of distribution it is to be regarded as a variation produced by environment, or at least not yet sufficiently distinct to be given a systematic position. If, on the other hand, the variant occurs in a region adjacent to that occupied by the parent species it does certainly deserve treatment by the taxonomist. This attitude is in a measure arbitrary and exceptions have been made when the variation seemed definite enough to warrant it. Besides these reasons for interest in geographical distribution there are certain phases of the subject that deserve consideration on their own account quite apart from any taxonomic or phylogenetic aspect. The preference of many of the species for calcareous soil has been noted, and as a matter of general interest this peculiarity has

been analyzed as far as possible with the data at hand. Certain theories of development depending upon range or area occupied have also been considered in relation to the present genus and evidence concerning their validity obtained. Finally, it has been attempted to procure definite data in regard to the distribution of *Lesquerella* that will serve on comparison with similar data procured from related genera to show any significant differences in the types of distribution.

The species of *Lesquerella* are native chiefly to the arid parts of western North America. Three species occur in South America. One of these, *L. mendocina*, seems to be rather widely distributed across northern Patagonia; another, *L. montevidensis*, has been reported from Uruguay; and the third, *L. frigida*, was collected in the high mountains of Venezuela. In North America three other isolated species are found: *L. arctica* in Greenland and on the shores of arctic America, *L. globosa* in Kentucky and Tennessee, and *L. Lescurii* in the immediate vicinity of Nashville, Tennessee. The remaining forty-six species occur in a nearly continuous area adjacent to the Rocky Mountains from Canada to the southern extremity of the Mexican plateau. On the east this region penetrates to eastern Texas and southwestern Missouri, and on the west to the states that border the Pacific Ocean. The geographical center of this continuous zone lies somewhere in northern New Mexico, but the region of greatest specific concentration is located in central Texas not far from the eastern edge of this area of continuous distribution. Utah and southern New Mexico are also rather remarkable for the number of species that occur within a small area (fig. 4).

*Point of Origin.*—There is much evidence for believing that *Lesquerella* originated at some point in central Texas and from this point as a center has spread over the large area that it now occupies. Other things being equal, one might suppose that migration would take place equally in all directions from the point of origin. It will be seen that the Texas region, although at one edge of the area of continuous distribution, is not far from the center of total distribution. That it is not at the exact center is obviously no argument against the present hypothesis. From purely theoretical standpoints also, the greatest number of species might be expected to occur in the vicinity of the point

of origin, since there the genus would have existed for the longest period of time. In the map showing distribution of species



Fig. 4. Geographical distribution of the species of *Lesquerella* in North America showing relative specific condensation.

in North America it is evident at once that the greatest specific concentration occurs in central Texas. It is quite possible, however, that the point of greatest concentration might coincide

with the approximate center of distribution without indicating the point of origin. Evidently much depends upon the character of the species that are here concentrated. Near the place of origin might also be expected the most primitive species. Let us then examine the species found in central Texas. There are ten of these: *L. auriculata*, *L. grandiflora*, *L. densiflora*, *L. Engelmannii*, *L. ovalifolia*, *L. argyraea*, *L. Fendleri*, *L. recurvata*, *L. gracilis*, and *L. Gordonii*. These species, it will be seen, all belong to the section *Eulesquerella* and are those that have been considered among the most primitive in the genus. Six of them are annuals, two have auriculate stem-leaves and filaments with dilated bases, and seven show no inhibition of the terminal bud. Every species of this group has glabrous, spherical pods, and in none is the average number of ovules less than five. Not only are these species primitive, but in no other locality may be found anything like an equal display of what have been considered ancestral characteristics for purely morphological reasons. With central Texas as a center, if one were to draw on the map a series of concentric circles, each succeeding ring would have fewer and fewer species with primitive characters. The periphery in general is bounded by highly specialized members of the genus. In a graphic representation of the subsectional groups they may be shown by lines radiating from a common center. Such a diagram could be superimposed upon a map and in nearly every case the species at the base of each line of development would be nearer the Texas region than species derived from it.

With such an accumulation of evidence pointing to central Texas as the place of origin, for the section *Eulesquerella* at least, and the entire absence of evidence pointing to some other locality as the birthplace of the genus it becomes at least possible to say that if this genus did not originate at this point, there is no evidence to show where it did appear. As for the other sections, it is only possible to say that there is no reason for believing they came into being at a different point. The first consists of a single species and the second of but three so that there is little chance for comparison here. The most primitive member of the second section, *L. lasiocarpa*, occurs in southern Texas and adjacent Mexico; next in order of complexity to it comes *L.*



*Schaueriana* of south central Mexico; and finally the most specialized of the three, *L. frigida*, has been reported from Venezuela. It remains a remarkable probability that from one point should have come so many lines of development.

Six species have been already mentioned as being rather widely isolated from any other representatives of the genus. It is quite worth while to examine these species in detail in order to determine if possible the significance of this isolation. There are at least two possibilities that would account for the location of these species. Either the continuous distribution of the genus may have been much greater formerly than at present and the species that occupied the intermediate areas may have since become extinct, or these isolated forms may owe their location to separate and fortuitous cases of long distance dispersal. If they do represent points in a former continuous distribution, judging from what we know of the other species and their increasing dissimilarity with increased distances from the supposed point of origin, we would expect these far-distant representatives to be the most aberrant and specialized members of the genus. As a matter of fact, the three species occurring in South America and the one in arctic America are very typical members of the genus and find their nearest relatives not in the species closest to them geographically, but in certain ones near the center of distribution. It is of interest also to note that the three South American plants differ considerably from one another and each finds its most nearly related form in North America. Due then to their dissimilarity from one another and their relationship to species near the center rather than on the periphery of the area of continuous distribution, it is thought likely that these four species occupy their present position because of some unknown agent of long-distance dispersal. The two species limited to Kentucky and Tennessee, however, do not seem to fall into the same category with the other isolated forms. Like them they are very dissimilar among themselves, but unlike them they are not similar to species rather near the hypothetical point of origin. Indeed, they are similar to no species now extant and they may well owe their isolation to the extinction of species that once occupied the intermediate areas. The occurrence of colonies of *L. argentea* in localities in Minnesota and Illinois is

curious and is perhaps to be explained by chance dispersal far from the original area occupied by the species.

*Occurrence of the Species upon Calcareous Soils.*—It is evident that many species of this genus occur upon calcareous soils. Pertinent data has been assembled in the hope of observing significant correlations between this habitat and previously obtained phylogenetic conclusions. The following species have been collected upon calcareous soil according to data preserved on herbarium sheets: *L. lasiocarpa*, *L. Schaueriana*, *L. densiflora*, *L. Engelmannii*, *L. ovalifolia*, *L. arctica* var. *Purshii*, *L. recurvata*, *L. gracilis* var. *sessilis*, *L. argyrea*, *L. Fendleri*, and *L. rectipes*. A. Gattinger, in the 'Flora of Tennessee,' notes that *L. Lescurii* occurs only upon calcareous soils. Fernald (*Rhodora* 13: 233. 1911) says that *L. arctica* var. *Purshii* in Newfoundland is a typical calciphile, and Kurtz (Rev. Museo La Plata 5: 286. 1893) observes that *L. mendocina* grows in dry and especially calcareous habitats. Mr. E. J. Palmer has told the author that *L. ovalifolia* seems restricted to limestone regions. Dr. Aven Nelson says that he has collected *L. condensata* upon outcroppings of limestone. Certain other species may be suspected of being calciphiles, since the regions from which they are reported are known to be very largely calcareous. *L. angustifolia* and *L. gracilis* belong to this category. An examination of this list of fifteen species shows a large number of primitive forms. Since the genus is believed to have originated in a region in which limestone is very frequent, this is not surprising. It is of considerable interest to note that primitive species in each of the three sections are calciphiles. Undoubtedly, many species of the genus are not limited to calcareous soils and many more probably never occur on them. Definite data on this point is very meager. *L. montana*, *L. diversifolia*, and *L. Garrettii* are known to grow in granitic soils. It will be noticed that these are highly specialized species. Before drawing any conclusions it must be said that from such fragmentary data no more than tentative results can be expected, and since many cruciferous plants are partial to limestone regions this partiality does not necessarily imply close relationship. However, it would seem that the immediate ancestors of *Lesquerella* were calciphytes. A bit of evidence in favor of a common origin



for the three sections is found in the partiality of primitive members of each for soils rich in lime. Similarly, certain widely isolated species are here united to the genus by an additional character.

*Jordan's Law of Isolation.*—It has been found through the study of geographical distribution of *Lesquerella* that in general Jordan's law of distribution holds good. This law is stated in the following terms: "Given any species in any region, the nearest related species is not likely to be found in the same region nor in a remote region, but in a neighboring district separated from the first by a barrier of some sort."<sup>1</sup> In Texas, species that seem not to differ greatly from one another are found in the same region, but practically without exception the species most nearly related is found in an adjacent region. As a rule, the ranges of related species overlap but little and this joint occupation may be apparent rather than real. That the species are separated by a barrier is not always demonstrable. It must be remembered, however, that our knowledge as to what constitutes a barrier is exceedingly limited. A change from calcareous to non-calcareous soil, or a slight difference in water content might form an effective barrier.

*Summary.*—*Lesquerella* seems to have arisen in the central Texas region, and from here the three sections and at least the *auriculata*, *Engelmannii*, *argyrea*, *recurvata*, and *gracilis* groups appear to have diverged. Since most of these various groups have reached a somewhat equivalent degree of specialization and have migrated long distances, it seems probable that they had their origin at about the same period. The Texas species at present appear to be in a rather static condition since the species are easily defined, but in New Mexico and Utah occur recent plexes of development to judge from the variability and number of the closely related species. From the Utah plexus it is believed that the genus *Physaria* has arisen. The primitive representatives of *Lesquerella* were probably partial to calcareous habitats. Since Jordan's law of isolation seems to be supported by the present study, it will be necessary to take into account the characteristic separation of specific ranges in any inquiry

<sup>1</sup> Jordan, D. S. The origin of species through isolation. Science N. S. 22: 545. 1905.

that seeks to explain the cause or mechanism of species formation in *Lesquerella*.

#### TAXONOMIC HISTORY OF LESQUERELLA

*Position of Lesquerella among Other Genera of the Cruciferae.*—There have been three rather recent treatments of the American genera of this family in which an endeavor was made to observe phylogenetic sequence. Prantl in 'Die Natürlichen Pflanzenfamilien' united six genera of more or less similar aspect into the subtribe *Physariinae* of the tribe *Schizopetaleae*. These genera are *Synthlipsis*, *Lyrocarpa*, *Dithyrea*, *Physaria*, *Lesquerella*, and *Phoenicaulis*. Robinson in Gray's 'Synoptical Flora of North America' retained this group with the exception of *Phoenicaulis*, under the tribal name of *Physarieae*. Von Hayek, in the most recent review of the family as a whole (Beih. Bot. Centralbl. 27: 310. 1911), preserves the designations and ranks proposed by Prantl, but transfers *Synthlipsis* to another subtribe of the *Schizopetaleae* and adds *Mancoa*, *Agallis*, *Sphaerocardamum*, *Stenonema* and *Notothlipsis* to the subtribe *Physariinae*. For *Lyrocarpa* he erects a separate subtribe. In a diagrammatic representation of the phylogeny of the tribe he derives *Lesquerella* from *Mancoa* and from *Lesquerella* he derives *Physaria*. This latter supposition is confirmed by the present study. The reason for relating *Lesquerella* to *Mancoa* is not evident. This latter genus is represented by a single annual species in the Andes of Peru and Argentina. It is further characterized by elongated, somewhat obcompressed, pubescent pods, and white flowers. Because of the obcompressed pods of the species in the section *Enantiocarpa* they have been referred by some authors to the genus *Synthlipsis*. As stated in another part of the present study, it is not believed that these species are at all related to the type of *Synthlipsis*. In fact, *Physaria* is the only genus that may with confidence be associated with *Lesquerella* at the present time. In any search for the group from which *Lesquerella* has been evolved the most primitive characters must be constantly borne in mind as well as the probable point of origin. What the ancestral genus was we do not yet presume to say.

*Previous Taxonomic Treatments of the Species of Lesquerella.*—The first species of this genus to be definitely recorded by science

were *L. arctica* and *L. globosa* in 1814. The first of these was described as a species of *Alyssum* by Hornemann and the second as a *Vesicaria* by Desvaux. Two years later Pursh described a third species as *Myagrum argenteum*. For nearly seventy-five years after the first species was described, the new species of this genus that were reported from time to time were almost without exception assigned to the genus *Vesicaria*. The first treatment of these American plants that pretended to be anything more than a mere compilation was published by Dr. Gray in 1850 in the Boston Journal of Natural History. This synopsis included nineteen species and was the outgrowth of the study made by Dr. Gray of the collections of F. Lindheimer in Texas. The second notable contribution to a knowledge of this group was published by Sereno Watson in the Proceedings of the American Academy of Arts and Sciences for 1888. Here Watson recognized thirty-three species and called attention to their generic dissimilarity to the Old World members of the genus *Vesicaria*. He proposed the name *Lesquerella* for the American forms "in honor of our venerable and in every way worthy paleontologist and bryologist, Leo Lesquereux." This revision remains essentially unchanged to-day except for the introduction of a number of species unknown to Watson and the incorporation of a definite theory of phylogeny. Subsequent to the publication of the 'Synoptical Flora of North America' in 1895, that contained a recapitulation of Watson's earlier work, no treatment of the genus as a whole has been attempted. The validity of *Lesquerella* as a generic concept has rarely, if ever, been questioned in America, and all recent students of the *Cruciferae* who have published on this group have realized that the American plants are not closely related to the European and Asiatic plants. The resemblance, although sometimes striking, is evidently superficial. Aside from the earlier taxonomic works on *Lesquerella*, we are greatly indebted to many recent treatments of the species of particular regions that have been published in various "Manuals" or "Floras."

*The Type Species of Lesquerella.*—It is becoming increasingly evident that taxonomists must base their generic concepts definitely on a certain species just as they base their specific concepts on a particular specimen. It is recognized that there

are within the genus, as here interpreted, three fairly distinct sections that from a narrower point of view might be considered separate genera. It is obviously necessary to locate that portion of the group that would retain the name *Lesquerella* were the sections elevated to generic rank. We must decide, if possible, upon a type species for the genus. Unfortunately *L. Lescurii* (Britton & Brown, Ill. Fl., ed. 2, 2: 154. 1913) has been previously designated as the type species because it occupies first place in the original publication of *Lesquerella*. This was apparently done without due regard to the very reasons that placed it first in the list of species. The International Rules of Botanical Nomenclature adopted at Vienna in 1905 are very clear as regards that portion of a genus that is to retain the original name. Article 45 reads in part: "When a genus is divided into two or more genera, the name must be kept and given to one of the principal divisions. If a genus contains a section or some other division, which, judging by its name or its species, is the type or origin of the group, the name is reserved for that part of it." The example for this point is taken from the genus *Helianthemum*. The genus contained originally nine sections; "several of these sections have since been raised to generic rank but the name *Helianthemum* has been kept for the divisions grouped round the section *Euhelianthemum*." In the original description Watson divided the genus into the sections "*Alysmus*" and "*Lesquerella*, proper." Probably because he regarded the first group as the more primitive as well as somewhat aberrant, he placed it first. The most aberrant species of all he placed first in the section. Of this species he said: "Our one flat-podded species that has been referred to *Alyssum* (*A. Lescurii*) appears to differ in no other respect than its less convex valves from a somewhat distinct group of species which can be separated, however, only as a section from the rest." To accept this species as the type species of the genus would certainly be contrary to what the author had in mind when he described the genus. If the genus were divided, a step we would greatly deplore, the International Rules point definitely to the section "*Lesquerella* proper," or "*Eulesquerella*," as the part that would retain the present generic name. From this section as outlined by Watson the type species

must certainly be selected. Watson lists *L. occidentalis* first under this group, and since the relationship of this species is clearly with the great mass of species attributed to this genus it is here designated as the type species of *Lesquerella*.

*Acknowledgments.*—The student of taxonomy is indebted to so many sources for his material that it is quite impossible to recognize even some of the most important in a formal manner. Personal gratitude may not be the criterion. The reader has, however, some rights in the matter and should know some of the sources of the material with which the author worked and the facilities at his disposal. The present study was made at the Missouri Botanical Garden, thanks to the generosity of the Director, Dr. George T. Moore, and under the constant supervision of Dr. J. M. Greenman, Curator of the Herbarium. Besides the collections in the Garden Herbarium specimens were borrowed from the United States National Herbarium, the Gray Herbarium, the Rocky Mountain Herbarium, the herbarium of Mr. George E. Osterhout of Windsor, Colorado, the herbarium of Prof. E. Bethel of Denver, Colorado, the Baker Herbarium at Pomona College, the herbarium of Mr. C. C. Deam, of Bluffton, Indiana, and the herbarium of Mr. I. W. Clokey, of Denver, Colorado. To the owners and curators of these various collections the author is greatly indebted.

*Illustrations.*—The illustrations were made by the author from herbarium material. The drawings of the trichomes were made with the aid of the camera lucida.

#### TAXONOMY

LESQUERELLA Watson, Proc. Am. Acad. 23: 249. 1888; Prantl in Engler & Prantl, Nat. Pflanzenfam. III. Abt. 2: 187. 1891; Coulter, Contr. U. S. Nat. Herb. 2: 17. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 116. 1895; Britton & Brown, Ill. Fl. 2: 136. 1897, ed. 2, 2: 154. 1913; Heller, Cat. N. Am. Pl. 88. 1900; Small, Fl. Southeastern U. S. 468. 1903, ed. 2, 468. 1913; Rydb. Fl. Colo. 154. 1906; Robinson & Fernald in Gray, Manual, ed. 7, 424. 1908; Coulter & Nelson, Manual Cent. Rocky Mountains, 218. 1909; Degen, Magyar Bot. Lap. 8: 3. 1909; Hayek, Beih. Bot. Centralbl. 27: 310. 1911; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 274. 1915; Rydb. Fl. Rocky Mountains, 331. 1917. "



*Vesicaria*, section *Vesicaria* DC. Syst. 2: 295. 1821, in part.  
*Vesicaria*, section *Vesicariana* DC. Prodr. 1: 159. 1824, in part; Walp. Rep. 1: 140. 1842, in part; Dietr. Syn. Pl. 3: 638. 1843, in part.

*Vesicaria* Torr. & Gray, Fl. N. Am. 1: 100. 1838; Gray, Gen. Am. Bor.-Or. Ill. 1: 161. 1848; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 37. 1851; Benth. & Hook. Gen. Pl. 1: 73. 1862, in part; Wats. Bibliog. Ind. N. Am. Bot. 74. 1878; Coulter, Manual Rocky Mountain Region, 25. 1885.

*Alyssum* Gray, Manual, ed. 5, 72. 1867, in part; Ktze. Rev. Gen. Pl. 2: 931. 1891.

*Synthlipsis* Wats. Bibliog. Ind. N. Am. Bot. 72. 1878, in part; Coulter, Contr. U. S. Nat. Herb. 2: 21. 1891, in part; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 121. 1895, in part; Small, Fl. Southeastern U. S. 468. 1903, ed. 2, 468. 1913.

*Alyssum*, section *Vesicariana* Ktze. in Post & Ktze. Lexicon Gen. Plant. 21. 1904, in part.

Annual, biennial, or perennial herbs more or less densely covered with branching or stellate hairs. Stems simple or branched, both terminal and lateral developing, or frequently, due to the more or less complete inhibition of the terminal bud, only the lateral produced from a basal rosette. Radical leaves from deeply pinnatifid and thin to oblanceolate and entire or even suborbicular and then usually thick. Cauline leaves in a few species auriculate at the base, but usually oblanceolate and subentire with a slender, cuneate petiole. Flowers sometimes large and showy, frequently rather small and inconspicuous; petals usually yellow, occasionally red or purple and rarely nearly white, entire, obovate to narrowly spatulate; filaments linear, edentate, in a few species dilated at the base. Pedicels straight, simply curved upwards, recurved or sigmoid. Pods sessile or stipitate, glabrous or stellate-pubescent, typically spherical, often flattened at the apex, sometimes elongated but rarely more than twice as long as wide; in one section the pods are strongly flattened parallel to the septum, in another at right angles to it. Styles persistent, usually long and slender. Stigmas capitate, slightly two-lobed or scarcely enlarged. Sepalum usually thin, nerved from the apex towards the base; areolae

from polygonal to tortuous; superimposed fibers wanting. Ovules 2-15 in each cell, funiculi attached to the septum for part of their lengths. Seeds more or less flattened, winged or immarginate; cotyledons accumbent, radical sometimes slightly turned to one side.

#### KEY TO THE SECTIONS

- Pods strongly flattened parallel to the septum, hirsute; stem-leaves auriculate..... §1. *Alysmus*  
 Pods various, if hirsute not flattened parallel to the septum; stem-leaves various.....  
   Valves compressed at right angles to the septum, pubescent.. §2. *Enantiocarpa*  
   Valves various but never compressed at right angles to the septum..... §3. *Eulesquerella*

#### SECTION 1. ALYSMUS Wats.

§ 1. *ALYSMUS* Wats. Proc. Am. Acad. 23: 250. 1888; Prantl in Engler & Prantl, Nat. Pflanzenfam. III. Abt. 2: 188. 1891; Wats. Syn. Fl. N. Am. 1': 116. 1895.

Annual, sparsely stellate; terminal bud developing into main stem; stems branching; radical leaves lyrate-pinnatifid, cauline leaves auriculate at the base; filaments dilated at the base; pods strongly flattened parallel to the septum, orbicular, sessile, sparingly stellate and ciliate; ovules 3-5 in each cell, funiculi free or attached to septum only at the base; seeds flat, narrowly winged. Species 1.

1. *Lesquerella Lescurii* (Gray) Wats. Proc. Am. Acad. 23: 250. 1888; Wats. Syn. Fl. N. Am. 1': 116. 1895; Chapman, Fl. Southern U. S. 29. 1897; Britton & Brown, Ill. Fl. 2: 154. 1913; Small, Fl. Southeastern U. S. 469. 1903, and ed. 2, 1913.

*Vesicaria Lescurii* Gray, Manual, ed. 2, 38. 1857; Torr. & Gray, Fl. N. Am. 1: 100. 1838.

*Alyssum Lescurii* Gray, Manual, ed. 5, 72. 1867.

Annual or biennial, sparsely stellate-pubescent, with few-rayed, rather loose stellae; stem repeatedly branching, particularly near the base, 1-3 dm. long; branches slender, spreading or ascending; terminal bud developing into main stem; radical leaves withering early, 4-10 cm. long, lyrate-pinnatifid, with rather few, remote segments, tapering to a slender petiole; cauline leaves thin, shallowly toothed, oblanceolate to ovate or narrower, 1-3 cm. long, auriculate at base; flowers yellow;



petals about 4 mm. long, broadly unguiculate, not enlarged at the base; filaments dilated at base; fruiting inflorescence elongated; pedicels ascending-divergent, about twice as long as the pods; pods erect, sessile, orbicular or slightly longer than broad, 3-5 mm. in diameter, strongly flattened parallel to the partition, valves slightly arched, hirsute with simple or sparingly branched hairs having conspicuously enlarged bases, small, stellate hairs sparingly intermixed; short midvein evident at base of valves; styles 1-2 mm. long; stigmas capitate; septum dense, nerved from apex over half way to base, areolae tortuous; ovules 3-5 in each cell, funiculi attached to septum only at the base; seeds flat, narrowly winged.

Distribution: in the vicinity of Nashville, Tennessee.

Specimens examined:

Tennessee: Nashville, 1855, *Lesquereux* (Mo. Bot. Gard. Herb.); "raised from seed sent me from Edgefield Junction," 1871, *Porter* (Mo. Bot. Gard. Herb.); hills around Nashville, April and May, 1879, *Gattinger* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Nashville, May, 1879, *Gattinger* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); near Nashville, June, 1880, *Hubbard 185* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Nashville, 1896, *Barnes*, (U. S. Nat. Herb.); west Nashville, May 26-27, 1909, *Eggleston 4419* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

A species of restricted range more or less anomalous in *Lesquerella* because of the strongly flattened pods and the septum which is quite different from that in most other species of the genus. Characters shown by this species—for example, auriculate stem-leaves, dilated filament-bases, and winged seeds—indicate its relationship to the more primitive species of the other sections, although they are not found in the majority of the species of the genus. It exhibits the characteristic median nerve of the septum found throughout the group. The dense septum is not greatly unlike that of some representatives of the section *Eulesquerella*. There remains, then, no character to keep this plant out of the genus *Lesquerella* except the pod flattened parallel to the septum, and it were much better to retain it with its relatives than to erect a monotypic genus on this character alone.

The limited range of this species is interesting because in the vicinity of Nashville, the only place it is known to occur, it is reported as being abundant. One wonders what the limiting factor in its distribution may be.

## SECTION 2. ENANTIOCARPA Payson

### § 2. ENANTIOCARPA Payson, new section.

Annuals or perennials; terminal bud usually developing into a fertile stem; radical leaves entire to lyrate; cauline leaves auriculate at the base and sessile or narrowed to a petiole; filaments gradually dilated at the base or linear; pods strongly compressed at right angles to the partition; seeds winged or im-marginate. Species 2-4.

### KEY TO THE SPECIES

Leaves more or less toothed or pinnatifid.

Pods nearly orbicular, pendent.....2. *L. lasiocarpa*

Pods elliptical, erect on sigmoid pedicels.....3. *L. Schaueriana*

Leaves quite entire.....4. *L. frigida*

2. *L. lasiocarpa* (Hook.) Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>st</sup>: 116. 1895; Small, Fl. Southeastern U. S. 469. 1903, and ed. 2, 469. 1913; Payson, Ann. Mo. Bot. Gard. 5: 143. 1918.

*Vesicaria lasiocarpa* Hook. (name only) Bot. Mag. N. S. 10: under t. 3464. 1836; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 150. 1850 (name only); Gray, Smithson. Contr. (Pl. Wright.) 5: 13. 1853 (description).

*Synthlipsis Berlandieri* Gray var. *hispida* Wats. Proc. Am. Acad. 17: 321. 1882; Coulter, Contr. U. S. Nat. Herb. 2: 21. 1891; Heller, Contr. Herb. Franklin and Marshall College 1: 40. 1895.

*S. heterochroma* Wats. Proc. Am. Acad. 17: 321. 1882.

*Alyssum lasiocarpum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Annual or biennial; somewhat canescent, with small, irregularly branching or stellate hairs and more or less hirsute with simple trichomes; stems decumbent or procumbent, 1-6 dm. long, in the larger plants usually branched; terminal bud of rosette usually developing; radical leaves thin, soon withering, often 1 dm. long, oblanceolate in outline, irregularly and deeply lyrate, obtuse, scarcely petioled; cauline leaves 1-6 cm. long, oblanceo-

late or obovate, often incisely pinnatifid, always conspicuously toothed, often more or less auriculate at the base; flowers at



Fig. 5. *L. lasiocarpa*. Habit sketch  $\times \frac{1}{2}$ . Trichomes  $\times 25$ .

first yellow, apparently turning purplish on withering; petals 6–10 mm. long, broad; filaments gradually dilated at the base; fruiting inflorescence elongated, open; pedicels slender, about 2 cm. long, recurved; pods pendent, sessile, decidedly flattened contrary to the septum, circular or obovate, 7–9 mm.

long, with small, stellately branching hairs intermixed with simple trichomes often enlarged at the base, young pods conspicuously hirsute; styles about 2 mm. long; stigmas conspicuous; septum membranous, nerved from apex toward the base, areolae somewhat tortuous; ovules 10–15 in each cell, funiculi long and slender, attached to septum at base; seeds flat, narrowly margined.

Distribution: southern Texas and northeastern Mexico.

Specimens examined:

Texas: railroads near Victoria, Victoria County, April 7, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Corpus Christi, March 5–12, 1894, *Heller 1405*, in part (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); shell marl banks along beach, Corpus Christi, March 8, 1917, *Palmer 11215* (Mo. Bot. Gard. Herb.); open ground, Alice, Jim Wells County, March 13, 1917, *Palmer 11259* (Mo. Bot. Gard. Herb.); Eagle Pass, May, 1883, *Havard* (U. S. Nat. Herb.); sands, Laredo, March 20, 1903, *Reverchon 3719* (Mo. Bot. Gard. Herb.); sandy banks of Rio Grande, Webb County, April 9, 1901, *Eggert* (Mo. Bot. Gard. Herb.); Brazos Santiagos, 1889, *Nealley 147* (U. S. Nat. Herb.).

Mexico:

Nuevo Leon: Feb.–Oct., 1880, *Palmer 33* (U. S. Nat. Herb.); Monterey, March, 1891, *Dodge 51* (U. S. Nat. Herb.); Hacienda

El Carrizo, Feb. 28, 1906, *Pringle 10236* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Tamaulipas: vicinity of Victoria, Feb. 1–April 9, 1907, *Palmer 41* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.).

Vera Cruz: vicinity of Pueblo Viejo, 2 kilometers south of Tampico, Feb. 10–25, 1910, *Palmer 366* (Mo. Bot. Gard. Herb.).

2a. Var. *Berlandieri* (Gray) Payson, new comb.

*Synthlipsis Berlandieri* Gray, Bot. Mex. Bound. Surv. 34. 1859; Small, Fl. Southeastern U. S. 468. 1903, ed. 2, 468. 1913.

This differs from the species in being less hirsute throughout and in having no simple trichomes whatever on the pods.

Distribution: From Corpus Christi, Texas, to Matamoros, Mexico.

Specimens examined:

Texas: Corpus Christi, March 5–12, 1894, *Heller 1405*, in part (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Corpus Christi, March 31, 1905, *Tracy 9348* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb., in part).

Mexico:

Tamaulipas: Matamoros, Feb., 1832, *Berlandier 3102* (Mo. Bot. Gard. Herb.); Matamoros, *Berlandier 3017* (U. S. Nat. Herb.).

*L. lasiocarpa* and its variety have been maintained in herbaria and literature for many years under two generic names, *Lesquerella* and *Synthlipsis*. Since its pods are flattened contrary to the narrow partition it has been associated with *Synthlipsis Greggii* from which in other respects it is quite different. It has, indeed, no characters to keep it out of *Lesquerella* and to the species of that genus it shows many points of similarity. In the author's opinion this species is to be considered rather near the great plexus of the genus from which arose the three sections. This view explains the many points of similarity to certain species placed in other sections.

3. *L. Schaueriana* (Kuntze) Payson, new comb.

*Vesicaria argentea* Schauer, Linnaea 20: 720. 1847; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 150. 1850.

*Lesquerella ? argentea* Wats. Proc. Am. Acad. 23: 252. 1888, not MacMillan.

*Alyssum Schauerianum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.  
*Synthlipsis lepidota* Rose, Contr. U. S. Nat. Herb. 8: 294.  
 1905.

Perennial, silvery stellate throughout; stellae small, rays numerous, equal, united for half their lengths or more; caudex woody, sometimes elongating; stems many, branching, procumbent to erect, 1.5–2.5 cm. long; terminal bud developing into a fertile stem; radical leaves narrowly oblanceolate to sub-



Fig. 6. *L. Schaueriana*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

lyrate with few teeth, acute, 3–6 cm. long; cauline leaves oblanceolate to nearly linear, entire, repand or with 2–6 sharp teeth, often cuneate at base, 1.5–3.5 cm. long; flowers inconspicuous; petals pale yellow, in age becoming somewhat purplish, 7 mm. long; filaments linear; fruiting inflorescence elongated; pedicels .5–1.5 mm. long, horizontal and sigmoid; pods strongly flattened at right angles to the septum, not keeled, erect, mid-vein lacking, elliptical or somewhat ovate, sessile, about 1 cm. long, on the mature pod the stellae are not contiguous; styles 1–2 mm. long; stigmas capitate; septum nerved from apex

more than half way to base, thin, areolae straight or somewhat tortuous; ovules 8–10 in each cell, funiculi attached to septum one-half their lengths or less; seeds neither margined nor winged.

Distribution: Central Mexico.

Specimens examined:

Mexico:

Hidalgo: calcareous soil near Tula, July 13, 1898, *Pringle* 6899 (Mo. Bot. Gard. Herb.); near Ixmiquilpan, 1905, *Rose, Painter & Rose* 8901 (U. S. Nat. Herb.); near Tula, July 3 and 4, 1905, *Rose, Painter & Rose* 8350 (U. S. Nat. Herb.); Hacienda Palmar, near Pachuca, July 21, 1905, *Rose, Painter & Rose* 8815 (U. S. Nat. Herb.).

This species is very distinct from any other known member of the genus. On account of the strongly flattened pods it is

associated with *L. lasiocarpa* to which it bears little resemblance in minor details. Petioled stem-leaves as opposed to auriculate ones, elliptical rather than circular pods, and immarginate instead of winged seeds are points of difference between the two species of this section.

No authentic material of Schauer's plant has been seen, but the original description of *Vesicaria argentea* agrees so closely with *Synthlipsis lepidota* Rose that there seems no doubt as to the identity of the type. Watson referred this plant to *Lesquerella* doubtfully, and Gray remarked that when the mature fruit was known it might prove to be a species of *Synthlipsis*. Like *L. lasiocarpa*, however, this plant shows no affinity with *Synthlipsis Greggii* and possesses no characters to keep it out of *Lesquerella*.

4. *L. frigida* (Turcz.) Payson, new comb.

*Vesicaria frigida* Turcz. Bull. Soc. Nat. Moscou 27: 296. 1854.

Cespitose perennial, stellate-pubescent throughout; lower part of the stem unifoliate, the rest naked, sparsely stellate; radical, cauline, and leaves of the sterile shoots tongue-shaped, obtuse, quite entire, grayish silvery; petals unknown; sepals saccate at the base; filaments dilated; placental and valvular nectar glands rather large; terminal raceme many-flowered; pedicels erect, exceeding the pods; pods sessile, valves inflated laterally, subimpressed in the middle, dorsally 1-nerved; styles half as long as the pods; septum entire, longitudinally nerved; ovules numerous, pendulous, funiculi filiform, almost entirely adnate to the septum; seeds immarginate, compressed parallel to the septum; cotyledons accumbent.

Distribution: collected by *Funck* and *Schlim* in the Sierra Nevada in the province of Merida, Venezuela, at an altitude of 11,000 feet.

This plant is known to me only by the original description from which the above was compiled. The plant is evidently a *Lesquerella* and undoubtedly to be associated with *L. Schaueriana* because of the obcompressed pods.



## SECTION 3. EULESQUERELLA Wats.

§ 3. EULESQUERELLA Wats. in Engler & Prantl. Nat. Pflanzenfam. III. Abt. 2: 1888. 1891.

*Lesquerella* proper. Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 117. 1895.

Annuals or perennials, frequently forming conspicuous rosettes; terminal bud developing or inhibited; stems usually unbranched; radical leaves pinnatifid or entire; stem-leaves usually entire; filaments rarely dilated at the base; pods glabrous or stellate, typically inflated, never flattened conspicuously at right angles to the septum, sessile or stipitate; ovules usually few, funiculi attached to the septum for one-half their lengths more or less; seeds rarely winged. Species 5-52.

## KEY TO THE SPECIES

- A. Cauline leaves auriculate.
  - a. Stems conspicuously hirsute at the base; petals 5-7 mm. long. . . . . 5. *L. auriculata*
  - b. Stems scarcely hirsute; petals often 1 cm. long. . . . 6. *L. grandiflora*
- B. Cauline leaves narrowed at the base.
  - a. Pods glabrous.
    - α. Plants annual.
      - I. Pedicels various but not uniformly recurved, with pods pendent.
        - 1. Pods sessile.
          - \* Ovules 5 or more in each cell; stems rather stout.
            - † Fruiting inflorescence crowded . . . . . 7. *L. densiflora*
            - †† Fruiting inflorescence lax. . . . . 26b. *L. gracilis* var. *sessilis*
          - \*\* Ovules 2 in each cell; stems slender. . . . . 24. *L. angustifolia*
        - 2. Pods definitely stipitate.
          - \* Pedicels straight or simply curved, ascending.
            - † Pods globose or oblong, without a shoulder at the base. . . . . 26. *L. gracilis*
            - †† Pods obpyriform, with a shoulder at the base. . . . . 26a. *L. gracilis* var. *repanda*
          - \*\* Pedicels distinctly sigmoid, usually horizontal.
            - † Radical leaves lyrate pinnatifid, with numerous acute segments; stipe over 1 mm. long. . . . . 25. *L. Lindheimeri*
            - †† Radical leaves entire or with few lobes; stipe less than 1 mm. long. . . . . 27. *L. Gordonii*
      - II. Pedicels uniformly recurved; pods more or less pendent.
        - 1. Ovules 4-6 in each cell; Texas species.
          - \* Flowers yellow. . . . . 18. *L. recurvata*
          - \*\* Flowers white. . . . . 19. *L. pallida*



2. Ovules 2 in each cell; coarse New Mexican species..... 20. *L. aurea*
- β. Plants perennial.
- I. Pedicels uniformly recurved; pods more or less pendent.
1. Rays of stellae united only at their bases ..... 14. *L. purpurea*
2. Rays of stellae united for about one-half their lengths..... 17. *L. pueblensis*
- II. Pedicels straight, simply curved upwards or sigmoid, not uniformly recurved; pods horizontal to erect.
1. Fruiting inflorescence subcorymbose or pods clustered near the apex of the stem.
- \* Styles equalling or exceeding the pods.
- † Radical leaves narrowly oblanceolate ..... 8. *L. Engelmannii*
- †† Radical leaves ovate..... 9. *L. ovalifolia*
- \*\* Styles much shorter than the pods.
- † Petiole of radical leaves stout; native to Greenland and Labrador ..... 11. *L. arctica*
- †† Petiole slender; native to Newfoundland and Anticosti..... 11a. *L. arctica*  
var. *Purshii*
- 2 Fruiting inflorescence elongated.
- \* Pods stipitate, basal leaves pinnatifid..... 25. *L. Lindheimeri*
- \*\* Pods sessile.
- † Radical leaves gradually narrowed at the base.
0. Ovules 2; stems many, slender ..... 24. *L. angustifolia*
00. Ovules more than 2; stems stouter.
- || Pedicels simply curved, not sigmoid.
- m. Styles usually equalling the pods in length..... 15. *L. Fendleri*
- n. Styles much shorter than the pods..... 11. *L. arctica*
- ||| Pedicels sigmoid, usually horizontal.
- m. Stellae not scale-like, rays distinct.
- : Leaves distinctly toothed; rays unbranched... 12. *L. argyrea*
- :: Leaves entire; rays branched. 29. *L. pinetorum*
- n. Stellae scale-like, rays united nearly or quite to their apices. 16. *L. Schaffneri*

- †† Radical leaves abruptly narrowed at base; pods oblong
- b. Pods stellate-pubescent.
- α. Pedicels uniformly recurved, not at all sigmoid.
- I. Plants annual; ovules 2..... 20. *L. aurea*
- II. Plants perennial; ovules usually more than 4.
1. Basal leaves linear or oblanceolate.
- \* Stems stout; fruiting racemes not secund..... 21. *L. argentea*
- \*\* Stems slender; fruiting racemes usually secund..... 22. *L. arenosa*
2. Basal leaves oval or suborbicular.... 23. *L. macrocarpa*
- β. Pedicels sigmoid, straight or uniformly curved upwards.
- I. Plants annual.
1. Pods globose; stems erect; terminal bud not inhibited.
- \* Pedicels sigmoid; stems usually simple..... 28. *L. Palmeri*
- \*\* Pedicels straight; stems branched. 35. *L. globosa*
2. Pods compressed at the apex; stems decumbent; rosette plants..... 51. *L. Cusickii*
- II. Plants perennial.
1. Radical leaves linear or narrowly oblanceolate.
- \* Fruiting inflorescence raised conspicuously above the leaves.
- † In well-developed plants, pods clustered at apex of stems.
0. Radical leaves thick, usually involute..... 38. *L. intermedia*
00. Radical leaves thinner, flat; stems more slender.
- || Stems with one or more leaves..... 39. *L. arizonica*
- ||| Stems leafless..... 39a. *L. arizonica* var. *nudicaulis*
- †† In well-developed plants, fruiting inflorescence elongated.
0. Pods sessile..... 40. *L. alpina*
00. Pods stipitate..... 42. *L. Garrettii*
- \*\* Fruiting inflorescence scarcely raised above the basal leaves.
- † Pubescence spreading..... 41. *L. condensata*
- †† Pubescence closely appressed. 41a. *L. condensata* var. *laevis*
2. Radical leaves oblanceolate, spatulate, oval, or suborbicular.
- \* Pods distinctly stipitate when mature, oblong..... 45. *L. latifolia*
- \*\* Pods sessile.
- † Rays of the stellae unbranched
- †† Rays of the stellae conspicuously forked.
0. Pods conspicuously elongated, when mature at least twice as long as wide.
13. *L. Berlandieri*

- || Pods obtuse or acute, but not compressed at the apex.
- m. Basal leaf blades narrowed gradually to the petiole.
  - : Pedicels sigmoid; stems erect or decumbent.
  - # Caudex not enlarged..... 33. *L. montana*
  - ## Caudex large, woody..... 33a. *L. montana* var. *suffruticosa*
  - :: Pedicels rarely sigmoid; stems prostrate..... 36. *L. mendocina*
- n. Basal leaf blades narrowed abruptly to the petiole.
  - : Stems erect or decumbent; pods not at all compressed..... 33. *L. montana*
  - :: Stems prostrate; pods slightly obcompressed..... 46. *L. Wardii*
- || || Pods compressed at the apex; pedicels conspicuously sigmoid..... 34. *L. curvipes*
- 00. Pods not conspicuously elongated.
- || Pods not flattened at the apex nor on the margins.
- m. Scarcely forming a rosette; terminal bud developing at least a short fertile stem.
  - : Stems branched; ovules 2 in each cell..... 35. *L. globosa*
  - :: Stems unbranched; ovules 5-6 in each cell..... 31. *L. lata*
- n. Forming a distinct rosette; terminal bud inhibited.
  - : Radical leaves gradually narrowed to the petiole.
  - # Stems erect; flowers yellow.
  - δ Tuft of radical leaves raised on an elongated caudex. 10. *L. montevidensis*

- |    |   |   |
|----|---|---|
| ♂♂ | Rosette sessile.  |   |
| ‡  | Ovules 4 or more...   | 32. <i>L. rectipes</i>                          |
| ‡‡ | Ovules usually 2.....   | 52. <i>L. Douglasii</i>                         |
| ## | Stems prostrate; flowers often red.....                       | 48. <i>L. cinerea</i>                           |
| :: | Radical leaves abruptly narrowed to the petiole.              |   |
| #  | Pods acute at the apex.                                       |   |
| ♂  | Radical leaves toothed; often subhastate....                  | 48. <i>L. prostrata</i>                         |
| ♂♂ | Radical leaves entire, suborbicular..                         | 46. <i>L. Wardii</i>                            |
| ## | Pods obtuse or truncate at the apex.                          |   |
| ♂  | Pods subglobose....   | 44. <i>L. Kingii</i>                            |
| ♂♂ | Pods truncate, obcompressed.                                  | 47. <i>L. utahensis</i>                         |
|    | Pods flattened at the apex and on the margins.                |   |
| m. | Stems erect or strongly ascending.                            |   |
| :  | Ovules usually 6.....   | 37. <i>L. valida</i>                            |
| :: | Ovules 2-4.   |   |
| #  | Radical leaves acute, stems usually less than 1 dm. long..... | 40a. <i>L. alpina</i><br>var. <i>spathulata</i> |
| #  | Radical leaves obtuse; stems 1-2 dm. long.....                | 50. <i>L. occidentalis</i>                      |
| n. | Stems prostrate or nearly so.                                 |   |
| :  | Caudex densely invested with former leaf-bases, woody...      | 49. <i>L. diversifolia</i>                      |
| :: | Caudex scarcely developed; annual or short-lived perennial.   | 51. <i>L. Cusickii</i>                          |

5. *L. auriculata* (Engelm. & Gray) Wats. Proc. Am. Acad. 23: 250. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 17. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 116. 1895; Small, Fl. South-eastern U. S. 469. 1903, and ed. 2, 1913.

*Vesicaria auriculata* Engelm. & Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 5: 240. 1847; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 38. 1851.

*Alyssum auriculatum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Annual or biennial, rather sparsely stellate with few-rayed hairs; stems hirsute, particularly at the base, rather stout, 1–2.5 dm. long, few to many from the base, mostly unbranched, decumbent and spreading; terminal bud developing; radical leaves 2–5 cm. long, oblanceolate in outline, lyrate toothed or subentire, usually obtuse, narrowed at the base but scarcely petioled; cauline leaves shallowly toothed or nearly entire, oblong, 1–3 cm. long, obtuse, sessile and auriculate at the base; flowers yellow; petals 5–7 mm. long; filaments abruptly and broadly dilated at the base; fruiting inflorescence elongated, rather crowded; pedicels ascending-divergent, 1–1.5 cm. long; pods erect, glabrous, sessile, globose, 4–6 mm. in diameter; styles about 2 mm. long; septum thin, areolae somewhat tortuous, nerved from the apex toward the base; ovules 6–8 in each cell, funiculi long and slender, attached to septum for about one-fourth their lengths; seeds narrowly winged.

Distribution: central Oklahoma to southern Texas.

Specimens examined:

Oklahoma: Kingfisher County, April 21, 1896, *L. A. Blankinship* (Rky. Mt. Herb.); Huntsville, Kingfisher County, April 10, 1896, *L. A. Blankinship* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); waste place near Kingfisher, Kingfisher County, April 26, 1913, *Stevens 188* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Texas: *Wright* (U. S. Nat. Herb.); sands, Big Sandy, April 7, 1902, *Reverchon 2967* (Mo. Bot. Gard. Herb.); sands, Terrell, April 5, 1903, *Reverchon 3717* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); sands, southwest of Dawson, April 16, 1903, *Reverchon* (Mo. Bot. Gard. Herb.); on right bank of the Brazos, Feb. 24, 1844, *Lindheimer* (Mo. Bot. Gard. Herb.); near San Felipe on the Brazos, March, 1844, *Lindheimer 217* (Mo. Bot.

Gard. Herb.); probably at San Antonio, 1878, *Ball 1697* (Mo. Bot. Gard. Herb.).

The glabrous pods and the auriculate cauline leaves serve at once to separate this species from all other species of *Lesquerella* except *L. grandiflora*, and from that species it is most easily distinguished by its hirsute stems and smaller flowers. The basal leaves in *L. auriculata*, from the specimens at hand, seem never to become so deeply pinnatifid as in *L. grandiflora*. Ball's specimen labelled "probably at San Antonio" may well be from farther north and east since it has not been confirmed by other collections from this locality.

6. *L. grandiflora* (Hook.) Wats. Proc. Am. Acad. 23: 250. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 17. 1891; Wats. in Gray, Syn. Fl. N. Am. 1': 116. 1895; Small, Fl. Southeastern U. S. 469. 1903, and ed. 2, 469. 1913.

*Vesicaria grandiflora* Hook. Bot. Mag. N. S. 10: t. 3464. 1836; Torr. & Gray, Fl. N. Am. 1: 101. 1838, and suppl. 668. 1840; Don, Sweet's Brit. Fl. Gard. 4: t. 404 1838; Walp. Rep. 1: 141. 1842; Dietr. Syn. Pl. 3: 638. 1843; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 37. 1851.

*V. brevistyla* Torr. & Gray, Fl. N. Am. 1: 102. 1838.

*V. grandiflora* Hook. var. *pinnatifida* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 146. 1850.

*Alyssum grandiflorum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Rather coarse annual or biennial, loosely stellate, pubescent with few-rayed stellae; stems at the base sparsely villous, erect or decumbent, 2-8 dm. long, simple or sparingly branched; terminal bud developing a fertile stem; radical leaves 3-10 cm. long, oblanceolate or oblong, variously pinnatifid, sometimes merely dentate, often pinnate with equal segments, acute or obtuse, narrowed to a sparingly villous petiole; cauline leaves lanceolate to oblong, conspicuously toothed, 1-3 cm. long, sessile and auriculate at the base; flowers yellow, large; petals often 1 cm. long, broad; filaments gradually dilated at the base; fruiting inflorescence elongated, open; pedicels divergent-ascending, often curved, 1-1.5 cm. long; pods erect, very shortly stipitate, nearly sessile, glabrous, globose or slightly longer than broad, 4-6 mm. in diameter; styles 1-1.5 mm. (rarely 2 mm.)

long, stigmas capitate, conspicuous; septum thin, nerved one-half its length, areolae not tortuous; ovules 4-6 in each cell, funiculi long, slender, attached to septum for about one-fourth their lengths; seeds flat, narrowly winged.

Distribution: south central Texas.

Specimens examined:

Texas: Houston, Harris County, April 10, 1903, *Biltmore Herbarium 14807* (U. S. Nat. Herb.); prairies west of Brazos, April 1, 1839, *Lindheimer* (Mo. Bot. Gard. Herb.); sand hill near Austin, May 15, 1872, *Hall 23* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); sands, Llano, May, 1885, *Reverchon* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); sandy soil, Babyhead, Llano County, May, 1887, *Reverchon* (Mo. Bot. Gard. Herb.); Columbus, April 8, 1907, *Howell 356* (U. S. Nat. Herb.); prairies west of Victoria, Feb., 1845, *Lindheimer* (Mo. Bot. Gard. Herb.); Victoria, April 28, 1905, *Tracy 9193* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Victoria, April 28, 1905, *Maxon 3815* (U. S. Nat. Herb.); dry open ground, Goliad, Goliad County, March 10, 1916, *Palmer 9136* (Mo. Bot. Gard. Herb.); Herbarium Texanum, *Berlandier 2538* (Mo. Bot. Gard. Herb.).

*L. grandiflora* possesses the largest flowers of any known member of the genus and is quite an attractive plant when in blossom. The specific name *brevistyla* was given by Torrey and Gray to a Texas plant which they believed to be distinct from *L. grandiflora*, judging from the illustration of that species in Sweet's 'British Flower Garden.' Later, with authentic material at hand, they recognized the two as identical. The variety  $\beta$ . *pinnatifida* differs from the species in having more deeply pinnate basal leaves and is probably only an ecological form. *L. grandiflora* is very close to *L. auriculata*. No intermediate specimens have been seen, however, and though the differences are slight the two plants may best retain their specific designa-



Fig. 7. *L. grandiflora*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .



tions. The range of the present species seems to be consistently west and south of that of *L. auriculata*.

7. *L. densiflora* (Gray) Wats. Proc. Am. Acad. 23: 251. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 17. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Small, Fl. Southeastern U. S. 469. 1903, ed. 2, 469. 1913.

*Vesicaria densiflora* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 145. 1850; Walp. Ann. 2: 138. 1851; Gray, Smithson. Contr. (Pl. Wright.) 3: 10. 1852.

*Alyssum densiflorum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Annual or biennial; cinerous throughout with rather loose stellae; stellae few-rayed with deep U-shaped fork on one side, rays distinct, long; stems several to many from the base, decumbent to erect, 1-5 dm. long, simple or branched; terminal bud producing a fertile stem; radical leaves oblanceolate, dentate or lyrate-pinnatifid, 3-7 cm. long; cauline leaves numerous, oblanceolate, usually shallowly toothed, narrowed at the base, 1.5-3 cm. long; petals yellow, narrowed to a slender claw, about 7 mm. long, filaments gradually dilated at the base; fruiting inflorescence short, crowded; pedicels straight, ascending or the lower almost horizontal, usually a little less than 1 cm. long; pods erect, substipitate, globose, glabrous, 3-5 mm. in diameter; styles

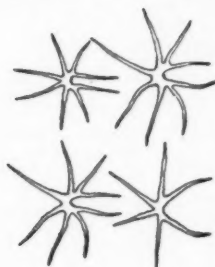


Fig. 8. Trichomes of *L. densiflora*.  $\times 25$ .

slender, 4-5 mm. long; stigmas capitate; septum thin, nerved, areolae slightly tortuous; ovules 5-10 in each cell, funiculi long and slender, attached to septum for about three-fourths their lengths; seeds neither margined nor winged.

Distribution: in a narrow area extending north and south across central Texas from Hood to Victoria counties.

Specimens examined:

Texas: 1892, *Nealley* (U. S. Nat. Herb.); sands, Falls Creek, Hood County, April, 1885, *Reverchon* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Comanche Peak near Granbury, May 5, 1900, *Eggert* (Mo. Bot. Gard. Herb.); rocky prairie, near Granbury, May 6, 1900, *Eggert* (Mo. Bot. Gard. Herb.); rocky up-

lands, Somerville County, April, 1882, *Reverchon* (Mo. Bot. Gard. Herb.); Waco, *Pace* (Mo. Bot. Gard. Herb.); Ft. Chadbourn, 1856, *Swift* (U. S. Nat. Herb.) limestone barrens, Brownwood, Brown County, March 31, 1917, *Palmer 11429* (Mo. Bot. Gard. Herb.); dry hills, Austin, May 20, 1872, *Hall 19* (Mo. Bot. Gard. Herb.); sandy open ground, Fredericksburg, Gillespie County, June 5, 1916, *Palmer 10076* (Mo. Bot. Gard. Herb.); Fredericksburg, May 9, 1899, *Bray 285* (U. S. Nat. Herb.); gravelly banks of rivulets near Fredericksburg, May, 1847, *Lindheimer 577* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); sandy soil on the lower Guadalupe, near Victoria, Feb., 1845, *Lindheimer 328* (Mo. Bot. Gard. Herb.); Womack, Victoria County, April 11, 1900, *Eggert* (Mo. Bot. Gard. Herb.); sandy open ground, Victoria, March 13, 1916, *Palmer 9153* (Mo. Bot. Gard. Herb.).

This species is of interest particularly because of the short, crowded inflorescence, a character that is carried a step farther in the subumbellate inflorescence of *L. Engelmannii*. From that species the annual habit also distinguishes *L. densiflora*. *L. argyrea* is similar in many ways to the present species but the former is distinctly perennial, the inflorescence elongated, and the pedicels usually sigmoid. *L. gracilis* has the annual habit of *L. densiflora*, but there again the inflorescence is elongated. In the stellae is to be found a character that serves definitely to separate this species from any other with which it might be confused except *L. Engelmannii*. In these two species the radial symmetry of the star is broken by a deeper U-shaped fork on one side—a character easily understood by comparison of the drawings of the stellae of the species under discussion.

8. *L. Engelmannii* (Gray) Wats. Proc. Am. Acad. 23: 254. 1888; Coulter, Contr. U. S. Nat. Herb 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Small, Fl. Southeastern U. S. 471. 1903, and ed. 2. 471. 1913; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909 (in part); Rydb. Fl. Rocky Mountains, 333. 1917.

*Vesicaria Engelmannii* Gray, Gen. Am. Bor.-Or. Ill. 1: 162. t. 70. 1848; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 144. 1850; Walp. Ann. 2: 39. 1851; Gray, Smithson. Contr. (Pl. Wright.) 3: 110. 1852.

*V. pulchella* Kunth & Bouché, Ann. Sci. Nat. Bot. III. 2: 229. 1849.

*V. Engelmannii* Gray, var.  $\beta$ . *elatio*r Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 145. 1850.

*Alyssum Engelmannii* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Perennial, canescent with a coarse, stellate pubescence, stellae rather conspicuously granular roughened, rays simple or forked at the base; caudex branching; stems usually many, erect or slightly decumbent, unbranched, 1.5–4 dm. long, usually lateral, the terminal bud producing a shorter sterile shoot; radical leaves 3–7 cm. long, narrowly lanceolate, acute, the outermost broader, nearly obovate, rarely persisting, all gradually narrowed to a slender petiole; cauline leaves narrowly oblanceolate to nearly linear, narrowed to a slender base, entire; flowers rather showy; petals yellow, spatulate, about 1 cm. long, filaments rather broad, gradually dilated toward the base; fruiting inflorescence typically subumbellate, pedicels nearly straight, from horizontal to erect, 1–1.5 cm. long; pods horizontal to erect, glabrous, globose, 4–7 mm. in diameter, stipe about 1 mm. long; styles slender, exceeding the pods; septum thickish, 5–6 in each cell, funiculi attached to septum for about three-fourths their lengths.

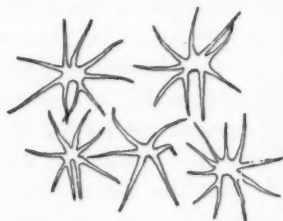


Fig. 9. Trichomes of *L. Engelmannii*.  $\times 25$ .

Distribution: from western Oklahoma south across central Texas.

Specimens examined:

Oklahoma: hillside, Shattuck, Ellis County, May 17, 1914, Clifton 3023 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Texas: calcareous rocky upland, Dallas, April, 1879, Reverchon (U. S. Nat. Herb.); rocky hills near Dallas, April, 1880, Reverchon (U. S. Nat. Herb.); calcareous soil, Dallas, April 1, 1900, Reverchon (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); calcareous soil near Dallas, April 10, 1900, Reverchon (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); limestone prairies, Five Mile Creek, Dallas County, April 30, 1900, Reverchon (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); dry, stony hills near West

Dallas, May 3, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Hood County, June, 1882, *Reverchon* (U. S. Nat. Herb.); rocky hill, Austin, May 20, 1872, *Hall 21* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Mt. Bonnell, near Austin, April 25, 1914, *Young* (Mo. Bot. Gard. Herb.); pebbly shore of the Guadalupe River, near New Braunfels, May, 1846, *Lindheimer 325* (Mo. Bot. Gard. Herb.); pebbly river banks, New Braunfels, May, 1848, *Lindheimer 576* (Mo. Bot. Gard. Herb.); New Braunfels, May, 1850, *Lindheimer 421* (Mo. Bot. Gard. Herb.); New Braunfels, May, 1850, *Lindheimer 667* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); New Braunfels, April, 1851, *Lindheimer 526* (Mo. Bot. Gard. Herb.); New Braunfels, April, 1851, *Lindheimer 666* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

This species and its northern relative, *L. ovalifolia*, are peculiar among the glabrous podded species in having typically a sub-umbellate inflorescence. Occasionally forms of *L. Engelmannii* occur, however, that have the usual elongated raceme of the genus. To this variation Gray gave the name var.  $\beta$ . *elator*. The type of *V. pulchella* probably also exhibits this character. Since, however, plants with an elongated flower cluster do not seem to be limited to any range, this variation has not been deemed worthy of taxonomic recognition.

*L. Engelmannii* is probably the most conspicuous member of the genus when in blossom, due in part to the large size of the flowers and in part to the manner in which they are clustered at the apices of the erect stems. The distribution of this species is evidently limited to calciferous soils.

9. *L. ovalifolia* Rydb. in Britton & Brown, Ill. Fl. 2: 137. 1897, and ed. 2, 2: 156. 1913; Rydb. Fl. Colo. 155. 1906; Petersen, Fl. Nebraska, 62. 1912; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 276. 1915, in part; Rydb. Fl. Rocky Mountains, 333. 1917.

*L. ovata* Greene, Pittonia 4: 308. 1901.

*L. Engelmannii* Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909.

Perennial, densely silvery stellate, stellae many-rayed, rays simple or branching, crowded, granular roughened; caudex frequently much branched; stems erect or decumbent, .5-2 dm.

long, unbranched, lateral, terminal bud remaining undeveloped or rarely elongating to form a short sterile shoot; radical leaves



Fig. 10. Trichomes of *L. ovalifolia*.  $\times 25$ .

broadly oblanceolate to nearly orbicular, entire, blade .5–2 cm. long, abruptly narrowed to a slender petiole 5–25 mm. long; cauline leaves linear-oblanceolate, rather few, entire; petals yellow, frequently over 1 cm. long, spatulate, filaments narrow, broader toward the base; fruiting inflorescence typically contracted and subumbellate, pedicels ascending or erect, .5–1.5 cm. long, pods ascending to erect, substipitate, glabrous,

globose or slightly oblong, 4–5 mm. in diameter, style slender, equalling or exceeding the pod; septum nerved, areolae not tortuous; ovules 5–8 in each cell, funiculi attached for more than half their lengths.

Distribution: western Oklahoma and Kansas, southwestern Nebraska, northern Texas, northeastern New Mexico, and southeastern Colorado.

Specimens examined:

Nebraska: hills of upper Lawrence Fork, Kimball County, Aug. 11, 1891, *Rydberg 22* (U. S. Nat. Herb.).

Kansas: gypsum hills, Rooks County, June 20, 1897, *Hitchcock 1077* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Coolidge, July, 1892, *Hitchcock* (Mo. Bot. Gard. Herb.).

Oklahoma: grassy mountain side, near Crusher Spur, Murray County, April 12, 1913, *Stevens 36* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Arbuckle Mountains, Davis, April 1, 1916, *Emig 498* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); dry gravelly banks, common, near Tishomoningo, Johnston County, April 15, 1916, *Houghton 3573* (Mo. Bot. Gard. Herb.); rough hillside, near Knowles, Beaver County, May 6, 1913, *Stevens 348* (Mo. Bot. Gard. Herb.).

Texas: rocky bluffs, Amarillo Creek, May 28, 29, 1902, *Reverchon* (Mo. Bot. Gard. Herb.); rocky bluffs, Galaduro, May 30, 1902, *Reverchon* (Mo. Bot. Gard. Herb.); rocky bluffs on Red River, Randall County, June 9, 1901, *Eggert* (Mo. Bot. Gard. Herb.); rocky bluff near Canyon City, Randall County, June 10,

1901, *Eggert* (Mo. Bot. Gard. Herb.); dry open ground, Canyon, Randall County, July 12, 1917, *Palmer 12526* (Mo. Bot. Gard. Herb.); plains and prairies, Post City, March 17, 1909, *Ruth 5* (U. S. Nat. Herb.); Glover's Pasture, Grady, Fisher County, April 14, 1901, *Shepherd* (U. S. Nat. Herb.).

Colorado: Rule Creek, Bent County, May 22, 1913, *Osterhout 4878* (Geo. Osterhout Herb.); bluffs of Arkansas at Pueblo, May, 1873, *Greene* (Mo. Bot. Gard. Herb.); mesas near Pueblo, May 14, 1900, *Rydberg & Vreeland 6142* (Rky. Mt. Herb.); Pueblo, May 23, 1914, *Bethel* (Rky. Mt. Herb.).

New Mexico: stony hills, Nara Visa, April 21, 1911, *Fisher 104* (U. S. Nat. Herb.).

*L. ovalifolia*, because of its contracted inflorescence, is likely to be confused with no other species except *L. Engelmannii* and to this species it is most closely related. The broader basal leaves, whose blades are abruptly narrowed to the petiole, and the denser, more silvery pubescence serve to give *ovalifolia* a different appearance. It is also a lower, more compact plant and shows the rosette habit quite definitely established. In *L. Engelmannii* the terminal bud normally develops a sterile shoot several centimeters in length. The ranges of the two species are consistently separated. *L. ovalifolia* is undoubtedly a distinct calciphyte.

10. *L. montevidensis* (Eichl.) Wats. Proc. Am. Acad. 23: 251. 1888.

*Vesicaria montevidensis* Eichl. in Mart. Fl. Bras. 13: 302. t. 67, fig. 2. 1865; Gilg & Muschler in Engl. Bot. Jahrb. 42: 466. 1909.

Perennial, silvery stellate-pubescent throughout, stellae many-rayed, rays forked at the base, distinct or irregularly coherent; caudex woody, branched, somewhat elongated; stems erect or decumbent, 3-6 dm. long; terminal bud remaining undeveloped or producing only a short sterile shoot; radical leaves oblanceolate, remotely dentate or subentire, 2.5-3.5 cm. broad, petiole short; cauline leaves narrowly oblanceolate, remotely dentate or subentire, acute; petals yellow, obovate; filaments slightly dilated at the base; fruiting inflorescence rather short; pedicels straight or simply curved, ascending; pods erect, sessile, ellip-



soid, 6-7 mm. long, 4-5 mm. broad, sparsely stellate-pubescent; styles 3-4 mm. long; septum nerved; ovules 3-4 in each cell; seeds not winged.

Distribution: Uruguay.

No specimens of this plant have been seen, but the figure in the 'Flora Brasiliensis' is so detailed, little doubt remains that this species is properly placed under *Lesquerella*. In appearance it is not unlike *L. Engelmannii* but its affinity to this species is of course merely conjectural.

11. *L. arctica* (Wormsk.) Wats. Proc. Am. Acad. 23: 254. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Britton & Brown, Ill. Fl. 2: 138. 1897, and ed. 2, 2: 156. 1913; Simmons, Rept. Second Norwegian Arctic Exp. in the Fram, No. 2, 95. 1906.

*Alyssum arcticum* Wormsk. ex Horne. Fl. Dan. 9: t. 1520. 1814.

*A. ? arcticum* DC. Syst. 2: 324. 1821.

*Vesicaria arctica* Richards in Frankl. Narr. First Jour. App. 743. 1823; Hook. Fl. Bor. Am. 1: 48. 1829; Torr. & Gray, Fl. N. Am. 1: 100. 1838; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 149. 1850; Durand, Jour. Acad. Nat. Sci. Phila. 3: 186. 1856; Busch, Zweite Deutsche Nordpolarfahrt 2, Abt. I: 30. 1874; Macoun, Cat. Canadian Pl. 1: 54. 1883; Meehan, Proc. Acad. Nat. Sci. Phila. 1893: 208. 1893.

Perennial, silvery stellate throughout with a dense scurfy pubescence; stellae small, many-rayed, rays confluent at the base; stems lateral, decumbent or nearly erect, 1-2 dm. long, unbranched; terminal bud remaining undeveloped; radical leaves densely rosulate on the thick caudex, 1-5 cm. long, thick, from spatulate to narrowly oblanceolate, entire, obtuse or acute, petiole broad; cauline leaves few, linear oblanceolate, entire, 8-15 mm. long, tapering to a narrow base; flowers rather few; petals yellow, 5-6 mm. long, scarcely narrowed to a claw; filaments rather stout, linear; fruiting inflorescence open, showing a tendency to remain corymbose; pedicels stout, erect or ascending, about 1.5 cm. long; pods erect, glabrous, sessile, globose or slightly elongated, 5-6 mm. in diameter; styles 1-2 mm. long, stigmas enlarged; septum thin, often perforate, nerved, areolae



slightly tortuous; ovules 6-8 in each cell, flat, not winged, funiculi rather short, attached to septum for about one-half their lengths.

Distribution: Greenland, Ellesmereland, and the arctic coast of America at least as far west as the Mackenzie River; extending southward on the coast of Labrador.

Specimens examined:

Greenland: *Drejer* (Mo. Bot. Gard. Herb.); Nettik, Aug. 4, 1861, *Hayes* 10 (U. S. Nat. Herb.); Itiblu Whale Sound, 1891, *Burk* 7 (U. S. Nat. Herb.); Borden Bay, Aug. 25, 1901, *Stein* 174 (U. S. Nat. Herb.); Borden Bay, Aug. 26, 1901, *Stein* 176 (U. S. Nat. Herb.); northeast coast about 76° 45' N. Lat., June 6, 1908, *Andr. Lundarr* (U. S. Nat. Herb.); Kangerdluarsuk kingua 74° 18', July 28, 1887, *Ryder* (Mo. Bot. Gard. Herb.); Nugsuak Patut, July, 1909, *Porsild* (Mo. Bot. Gard. Herb.).

11a. Var. *Purshii* Wats. Proc. Am. Acad. 23: 254. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Britton & Brown, Ill. Fl. 2: 138. 1897, and ed. 2, 2: 156. 1913; Fernald, Rhodora 13: 223. 1911.

A more slender plant than the species and with narrower leaves. Watson described the variety as having an entire septum in contradistinction to the species which was thought to have a perforate septum. This character is apparently of no value, since specimens of typical *arctica* are at hand that show no perforation. Frequently a few scattering stellae may be found on the otherwise glabrous pods, a character occurring more rarely in the species. From available material the variety seems to have but 5-6 ovules in each cell, while the species has 6-8. This, of course, is of slight value for identification but is of interest in its phylogenetic significance. This plant (var. *Purshii*) is, according to Fernald, a typical calciphile. Few flowering plants penetrate nearer the pole than *L. arctica*.

Distribution: Anticosti Island in the Gulf of St. Lawrence and western Newfoundland.

Specimens examined:

Newfoundland: dry limestone barren, Table Mountain, Port au Port Bay, July 16 and 17, 1914, *Fernald & St. John* 216 (Mo. Bot. Gard. Herb., Deam Herb., and Rky. Mt. Herb.); dry lime-

stone barrens, Table Mountain, region of Port au Port Bay, Aug. 16, 1910, *Fernald & Wiegand 3465* (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.).

12. *L. argyraea* (Gray) Wats. Proc. Am. Acad. 23: 254. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Small, Fl. Southeastern U. S. 471. 1903, and ed. 2, 471. 1913.

*Vesicaria argyraea* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 146. 1850; Walp. Ann. 2: 39. 1851; Wats. Proc. Am. Acad. 17: 319. 1852.

*V. recurvata* Gray, Smithson. Contr. (Pl. Wright.) 5: 13. 1853.

*Alyssum argyreum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Perennial, canescent with coarse stellae, rays few to many, distinct or slightly united at the base, unbranched; stems spreading, procumbent, 1-5 dm. long, usually unbranched; terminal bud remaining undeveloped; radical leaves entire, repand or lyrate, oblanceolate, 2-6 cm. long, narrowed to a slender petiole at the base; cauline leaves very numerous, from very narrowly oblanceolate to ovate, usually toothed, narrowed at the base, 1-4 cm. long; petals yellow, broadly spatulate, 6-9 mm. long; filaments linear; fruiting inflorescence elongated; pedicels horizontally spreading, usually more or less sigmoid by the upwardly curved apex, 1-2 cm. long; pods erect, sessile, glabrous, globose, 3-5 mm. in diameter; styles 2-4 mm. long, stigmas capitate; septum thin, nerved, areolae slightly or not at all tortuous; ovules 8-16 in each cell, funiculi long and slender, attached to septum for more than one-half their lengths; seeds small, not winged.

Distribution: southwestern Texas and northeastern Mexico. Specimens examined:

Texas: Llano, May 12-16, 1899, *Bray 304* (U. S. Nat. Herb.); Llano County, May, 1884, *Reverchon* (Mo. Bot. Gard. Herb.); Llano, May, 1888, *Reverchon 1489* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Jim Creek, Gillespie County, *Jermy 244* (Mo. Bot. Gard. Herb.); New Braunfels, April, 1850, *Lindheimer 670* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); New Braunfels, April, 1850, *Lindheimer 367* (Mo. Bot. Gard. Herb.); Cuero,

March 22, 1907, *Howell 332* (U. S. Nat. Herb.); prairie near Victoria, Feb., 1845, *Lindheimer 303* (Mo. Bot. Gard. Herb.); sandy banks of Green Lake near the mouth of Guadalupe, Feb., 1845, *Lindheimer 329* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); shell marl banks near bay, Corpus Christi, March 8, 1917, *Palmer 11219* (Mo. Bot. Gard. Herb.); rocks near Goliad, April 9, 1900, *Eggert* (Mo. Bot. Gard. Herb.); sandy open ground, Refugio, March 9, 1916, *Palmer 9121* (Mo. Bot. Gard. Herb.); Brackett, March 21, 1900, *Trelease 21* (Mo. Bot. Gard. Herb.); Ft. Clark, Kinney County, March 22, 1893, *Mearns 1336* (U. S. Nat. Herb.); Ft. Clark, Kinney County, Feb. 27, 1893, *Mearns 1246* (U. S. Nat. Herb.); Eagle Pass, April, 1883, *Havard* (U. S. Nat. Herb.); sands, Laredo, March 29, 1903, *Reverchon 3718* (Mo. Bot. Gard. Herb.); sandy banks of Rio Grande, Webb County, April 6, 1901, *Eggert* (Mo. Bot. Gard. Herb.); stony prairies on the Pinto Creek, western Texas, May, 1851, *Wright 849* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); valley of the Rio Grande, *Parry, Bigelow, Wright & Schott 43* (U. S. Nat. Herb.); western Texas, Oct., 1849, *Wright 15* (U. S. Nat. Herb.).

Mexico:

Nuevo Leon: Monterey and Pico Chico, March 18, 1900, *Canby 21* (U. S. Nat. Herb.); Monterey, Feb. 20, 1900, *Trelease 22* (Mo. Bot. Gard. Herb.).

Coahuila: valley of the Rio Grande near Piedras Negras, April 27, 1900, *Pringle 9182* (U. S. Nat. Herb.); Sabinas, May 21, 1902, *Nelson 6771* (U. S. Nat. Herb.); Saltillo, March 3, 1847, *Gregg 292* (Mo. Bot. Gard. Herb.); Sierra Madre, 40 miles north of Saltillo, July 25-31, 1880, *Palmer 30* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Saltillo, 1898, *Palmer 182* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Chojo Grande, 27 miles southeast of Saltillo, Aug. 29, 1904, *Palmer 372* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); battlefield near Buenavista, March 19, 1847, *Gregg 315* (Mo. Bot. Gard. Herb.); Buenavista, Feb. 14, 1847, *Gregg 90* (Mo. Bot. Gard. Herb.); Parras, March, 1905, *Purpus 1024* (Baker Herb. at Pomona College, and Mo. Bot. Gard. Herb.).

San Luis Potosi: Rio Verde, June 2-8, 1904, *Palmer 464* (U. S. Nat. Herb.); in the region of San Luis Potosi, 1878, *Parry & Palmer 25* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.);

Minas de San Rafael, Nov., 1910, *Purpus* 4920 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

The outstanding characteristics of this species are the coarse pubescence with the unbranched rays, the perennial habit, the numerous cauline leaves, the doubly curved pedicels, the glabrous, sessile pods, and the numerous ovules. Among the annual species it is sometimes confused with *L. gracilis* or *L. Gordonii*. From both of these the sessile pods serve to separate it. The absence of a gynophore also distinguishes it from *L. Lindheimeri* of the biennial or perennial species.

13. *L. Berlandieri* (Gray) Wats. Proc. Am. Acad. 23: 252. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 118. 1895.

*Vesicaria Berlandieri* Gray, in herb.; Wats. Bibliog. Ind. N. Am. Bot. 1: 75. 1878 (name only).

*Alyssum Berlandieri* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Perennial, silvery canescent throughout, stellae closely contiguous, rays few to many, simple, distinct from near the base; stems slender, procumbent or ascending, 1-3 dm. long, simple or branched; terminal bud remaining undeveloped; radical leaves 2-8 cm. long, entire, undulate or lyrate with very large terminal lobes, obtuse, narrowed at the base to a slender petiole; cauline leaves 1.5-2.5 cm. long, sinuately dentate to nearly entire,



Fig. 11. *L. Berlandieri*. Habit sketch  $\times \frac{1}{6}$ . Trichomes  $\times 25$ .

oblanceolate or broader, narrowed to a slender petiole; petals yellow, sometimes apparently turning reddish on fading, spatulate; filaments linear; fruiting inflorescence elongated; pedicels sigmoid, horizontal or somewhat recurved, 8-15 mm. long; pods erect, stellate-pubescent, sessile, subglobose or oblong, about 4 mm. in diameter; styles slender, 3-4 mm. long; septum nerved, areolae not tortuous; ovules 4-7 in each cell, funiculi attached for about half their lengths; seeds neither winged nor margined.

Distribution: State of Tamaulipas, Mexico.

Specimens examined:

Mexico:

Tamaulipas: near Matamoras, April, 1831, *Berlandier* 884, 2314 (Gray Herb. TYPE); San Fernando, Oct., 1830, *Berlandier* 819, 2239 (Gray Herb.); Soto la Marina, March 2, 1902, *Nelson* 6631 (U. S. Nat. Herb.).

This species finds its nearest relative in *L. argyraea* and from it is at once separated by the stellate pods and the reduced number of ovules. *L. Berlandieri* is of especial interest because it is the only species of this group that has developed a stellate-pubescent pod. In aspect it is not unlike certain species of the Rocky Mountain region but is easily distinguished from any of them by the simple rays of the stellae.

14. *L. purpurea* (Gray) Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 17. 1891; Wats. in Gray, Syn. Fl. N. Am. 1': 119. 1895; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915; Armstrong, Field Book of Western Wild Flowers, 184. 1915.

*Vesicaria purpurea* Gray, Smithson. Contr. (Pl. Wright.) 5: 14. 1853; Walp. Ann. 4: 196. 1857; Torr. Bot. Mex. Bound. Survey, 33. 1859.

*V. purpurea* Gray var. *albiflora* Torr. Bot. Ives' Rept. 6. 1860.

*Alyssum purpureum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Perennial, silvery stellate throughout, rays usually not forked, numerous, slightly coherent at base; stems decumbent or erect, 1-4 dm. long, simple or sparingly branched; terminal bud remaining undeveloped or producing only a short sterile shoot; radical leaves oblanceolate to oval, entire, repand or lyrate



Fig. 12. *L. purpurea*. Habit sketch  $\times \frac{1}{3}$ . Trichomes  $\times 25$ .

pinnatifid, obtuse, 2-12 cm. long, narrowed at base into a slender petiole; cauline leaves rather remote, oblanceolate, entire, acute or obtuse, 7-25 mm. long; petals white, pink or purplish, 7-9 mm. long, blade narrowed to a distinct claw; filaments slightly broader at the base; fruiting inflorescence elongated; pedicels slender, horizontal to recurved, 6-15 mm. long; pods horizontal to pendent, sessile, glabrous, globose, 4-6 mm. in diameter; styles about 2 mm. long; septum strongly nerved, areolae inclined to be tortuous; ovules 2-5 in each cell, funiculi short, attached to septum for about one-half their lengths; seeds flat, not winged.

Distribution: southwestern Texas, southern New Mexico, southeastern Arizona, northern Sonora, Chihuahua and Coahuila.

Specimens examined:

Texas: Chenates region, 1889, *Nealley 477* (U. S. Nat. Herb.); mouth of Pecos River, Oct., 1883, *Havard* (U. S. Nat. Herb.); Langtry, Val Verde County, Oct., 1892, *Nealley 121a* (U. S. Nat. Herb.); Roma, Starr County, 1899, *Nealley 268* (U. S. Nat. Herb.); stony hills near El Paso, March and April, 1852, *Wright 1320* (Mo. Bot. Gard. Herb.); El Paso, 1881, *Vasey* (U. S. Nat. Herb.); El Paso, April 17, 1884, *Jones 3722* (U. S. Nat. Herb.); dry hills, vicinity of El Paso, 1911, *Stearns 137* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

New Mexico: Organ Mountains, May 15, 1892, *Wooton* (U. S. Nat. Herb.); Filmore Canyon, Organ Mountains, Aug. 4, 1895, *Wooton* (U. S. Nat. Herb.); Organ Mountains, Sept. 4, 1897, *Wooton* (U. S. Nat. Herb.); Organ Mountains, April 15, 1899, *Wooton* (U. S. Nat. Herb. and Deam Herb.); Organ Mountains, March 18, 1900, *Wooton* (U. S. Nat. Herb.); Organ Mountains, April 4, 1903, *Wooton* (U. S. Nat. Herb.); Bishop's Cap, Organ Mountains, March 30, 1905, *Wooton* (U. S. Nat. Herb.); Van Pattens, Organ Mountains, June 10, 1906, *Standley* (U. S. Nat. Herb.); Organ Mountains, June 9, 1906, *Standley* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Florida Mountains, March 7, *Herrick 304* (U. S. Nat. Herb.); Big Hatchet Mountain, May 18, 1892, *Mearns 4* (U. S. Nat. Herb.).

Arizona: common in the Huachuca Mountains near Igo's ranch, April 11, 1908, *Tidestrom 827* (U. S. Nat. Herb.); brushy



slopes, Bisbee, Mule Mountains, April, 1909, *Goodding* 61 (Rky. Mt. Herb.); gravelly hills, San Francisco Mountains, March 21, 1881, *Rusby* 15 (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Lowell, May, 1884, *Parish* (U. S. Nat. Herb.); Sanoita Valley, April, 1880, *Lemmon* (U. S. Nat. Herb.); Sabina Canyon, March 20, 1897, *Zuck* (U. S. Nat. Herb.); Santa Catalina Mountains, May 14, 1883, *Pringle* (U. S. Nat. Herb.); Santa Rita Forest Reserve, March 31–April 23, 1903, *Griffiths* 4146 (U. S. Nat. Herb.); Willow Spring Mountains, March 13–April 23, 1903, *Griffiths* 3646 (U. S. Nat. Herb.); shaded places, Sierra Tucson, April 29, 1884, *Pringle* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Agua Verde Creek, April 23, 1914, *Harris* C. 1485 (U. S. Nat. Herb.); canyons near Camp Grant, April 2, 1867, *Palmer* (Mo. Bot. Gard. Herb.).

Mexico:

Chihuahua: shaded ledges, hills near Chihuahua, Oct. 24, 1886, *Pringle* 949 (U. S. Nat. Herb.); vicinity of Chihuahua, April 8–27, 1908, *Palmer* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Santa Eulalia Hills, July 30, 1885, *Wilkinson* (U. S. Nat. Herb.); Santa Eulalia Mountains, April 4, 1908, *Rose* 11692 (U. S. Nat. Herb.); vicinity of Cusihiuriachic, April 2 and 3, 1908, *Rose* 11652 (U. S. Nat. Herb.).

*L. purpurea* is one of the most distinctive species of the genus and is likely to be confused with no other species. Its distinguishing characteristics are the perennial root with the rosette of broad, silvery leaves, the white or purplish flowers, and the glabrous pods on pedicels that are normally recurved in age. It apparently flowers frequently in the late summer or fall.

15. *L. Fendleri* (Gray) Wats. Proc. Am. Acad. 23: 254. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909; Clements & Clements, Rocky Mountain Flowers, 25. 1914; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 276. 1915.

*Vesicaria Fendleri* Gray, Mem. Am. Acad. N. S. (Pl. Fendl.) 4: 9. 1849; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 149. 1850; Walp. Ann. 2: 39. 1851; Torr. & Gray, Pac. Rail. Rept. 2: 160. 1855; Torr. Pac. Rail. Rept. 5: 66. 1856; Coulter,

Manual Rocky Mountain Region, 25. 1885.

*V. stenophylla* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 149. 1850; Walp. Ann. 2: 39. 1851; Gray, Smithson. Contr. (Pl. Wright.) 3: 10. 1852; Walp. Ann. 4: 196. 1857; Porter & Coulter, Syn. Fl. Colo. 6. 1874.

*V. stenophylla* Gray, vars.  $\beta$ . *procera*,  $\gamma$ . *siliculis ovatis*,  $\delta$ . *humilis* and  $\epsilon$ . *diffusa* Gray, Smithson. Contr. (Pl. Wright.) 5: 13. 1853.

*Alyssum Fendleri* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella foliacea* Greene, Pittonia 5: 134. 1903.

*L. stenophylla* Rydb. Bull. Torr. Bot. Club 33: 142. 1906; Rydb. Fl. Colo. 155. 1906; Rydb. Fl. Rocky Mountains, 333. 1917.

*L. praecox* Wooton & Standley, Contr. U. S. Nat. Herb. 16: 126. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 276. 1915.

Perennial, caudex usually branched; plant silvery stellate throughout with closely overlapping stellae, rays numerous, simple, confluent from one-third to two-thirds their lengths; stems simple or branching, tufted, mostly erect, .5-3 dm. long, leafy; terminal bud developing a fertile stem; radical and cauline leaves similar, linear to linear-oblongate, entire or variously toothed, 1-4 cm. long, narrowed to a slender base; petals yellow, often nearly 1 cm. long, broadly spatulate; filaments filiform; fruiting inflorescence elongated or short and crowded, sometimes scarcely exceeding the leaves; pedicels erect or strongly ascending, .5-2 cm. long; pods erect, sessile, glabrous, globose or elongated, 3-7 mm. in diameter; styles 2-6 mm. long, slender; stigmas capitate; septum thin, nerved, areolae not tortuous; ovules 8-16 in each cell, funiculi long and slender, attached to the septum for one-half their lengths or more; seeds not margined.

Distribution: southwestern Kansas, western Texas, southeastern Colorado, New Mexico, southeastern Utah, western Arizona, and north central Mexico.

Specimens examined:

Kansas: without definite locality, 1876, *Popenoe* (U. S. Nat. Herb.).

Texas: Spafford Junction, March 22, 1900, *Canby* 18 (U. S. Nat. Herb.); near Cormidos, Nov., 1881, *Havard* (U. S. Nat.

Herb.); Davis Mountains, April 29, 1902, *Tracy & Earle 338* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); dry, rocky, open ground, Boerne, Kendall County, April 6, 1917, *Palmer 11479* (Mo. Bot. Gard. Herb.); Canyon City, June 10, 1901, *Eggert* (Mo. Bot. Gard. Herb.); sandy bluffs, upper Concho, April, 1882, *Reverchon* (U. S. Nat. Herb.); middle fork of Concho, April, 1882, *Reverchon* (Mo. Bot. Gard. Herb.); rocky prairies near Big Spring, Howard County, June 11, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Big Spring, May 12, 1902, *Tracy 8044* (Mo. Bot. Gard. Herb.); rocky places on the south Llano, June, 1884, *Reverchon* (Mo. Bot. Gard. Herb.); dry bluffs, upper Llano, June, 1885, *Reverchon* (U. S. Nat. Herb.); prairies at the head of the Limpio, June, 1851, *Wright 852* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); bluffs of Pecos River, Sept., 1881, *Havard* (U. S. Nat. Herb.); plains west of Pecos, April 20, 1902, *Tracy & Earle 143* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); vicinity of Pecos City, Oct. 14, 1913, *Rose & Fitch 17908* (U. S. Nat. Herb.); Barstow, April 15, 1902, *Tracy & Earle 31* (U. S. Nat. Herb.); near Burgess water hole, W. Texas, July, 1883, *Havard 72* (U. S. Nat. Herb.); plains west of Guadalupe Mountains, Nov., 1881, *Havard* (U. S. Nat. Herb.); rocky prairies on Turkey Creek, May, 1851, *Wright 850* (Mo. Bot. Gard. Herb.); western Texas to El Paso, Oct., 1849, *Wright 16* (U. S. Nat. Herb.); stony hills near El Paso, March, 1852, *Wright 1319* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); El Paso, 1881, *Vasey* (U. S. Nat. Herb.); rocky hills near Van Horn, El Paso County, July 9, 1900, *Eggert* (Mo. Bot. Gard. Herb.); sandy ground near Sierra Blanca, May 15, 1901, *Eggert* (Mo. Bot. Gard. Herb.); "Camp Charlotte," W. Texas, 1889, *Nealley 700, 701* (U. S. Nat. Herb.); near Rio Grande, June, 1904, *Jermy* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Colorado: Rule Creek, Bent County, June 10, 1910, *Osterhout 4412* (Geo. Osterhout Herb.); La Junta, June 19, 1909, *Osterhout 3965* (Geo. Osterhout Herb.); mesas near Pueblo, May 14, 1900, *Rydberg & Vreeland 6143* (Rky. Mt. Herb.); Swallow's, between Pueblo and Canyon City, June 1, 1901, *Baker 2* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., Geo. Osterhout Herb., Baker Herb. at Pomona College, and U. S. Nat. Herb.); Canyon City, 1872, *Brandege 345* (Mo. Bot. Gard.

Herb.); Brantly Canyon, Las Animas County, June 10, 1900, *Osterhout 2050* (Rky. Mt. Herb., Geo. Osterhout Herb., and Baker Herb. at Pomona College).

New Mexico: without definite locality, 1851, *Wright 851* (U. S. Nat. Herb.); McArty's Ranch, Aug. 6, 1880, *Rusby 16* (Mo. Bot. Gard. Herb.); vicinity of Farmington, San Juan County, July 17, 1911, *Standley 7091* (U. S. Nat. Herb.); Nara Visa, April 19, 1911, *Fisher 105* (U. S. Nat. Herb.); smaller hills around Santa Fe, May 2, 1847, *Fendler 40* (Mo. Bot. Gard. Herb.); dry, gravelly hills, Santa Fe, May 25, 1847, *Fendler 39* (Mo. Bot. Gard. Herb.); on hills at Santa Fe, May 13, 1897, *Heller 3516* (Baker Herb. at Pomona College); Acoma, May, 1882, *Bandelier* (Mo. Bot. Gard. Herb.); Kelly, May 13, 1895, *Herrick 537* (U. S. Nat. Herb.); Gallinas Mountains, Aug. 27, 1904, *Wooton* (U. S. Nat. Herb.); Roswell, Chaves County, April 18, 1898, *Skehan 3* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., Geo. Osterhout Herb., and U. S. Nat. Herb.); Arroyo Ranch near Roswell, May 4-9, 1903, *Griffiths 4250* (Mo. Bot. Gard. Herb.); Fort Smith to the Rio Grande, 1853-4, *Bigelow* (U. S. Nat. Herb.); road to Apache Teju, Aug. 3, 1895, *Mulford 614* (Mo. Bot. Gard. Herb.); Queen, Aug. 1, 1909, *Wooton* (U. S. Nat. Herb.); in the valley of the Rio Grande, below Dona Ana, *Parry, Bigelow, Wright & Schott 42* (U. S. Nat. Herb.); Tortugas Mountain, Dona Ana County, April 22, 1894, *Wooton* (U. S. Nat. Herb.); Organ Mountains, Dona Ana County, July 15, 1897, *Wooton 155* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., and U. S. Nat. Herb.); Filmore Canyon, Organ Mountains, April 29, 1899, *Wooton* (U. S. Nat. Herb.); Filmore Canyon, Organ Mountains, April 15, 1899, *Wooton* (U. S. Nat. Herb.); Organ Mountains, April 24, 1900, *Wooton* (Rky. Mt. Herb.); mesa west of the Organ Mountains, March 17, 1900, *Wooton* (U. S. Nat. Herb.); mesa west of Organ Mountains, March 2, 1902, *Wooton* (Deam Herb.); Bishop's Cap, Organ Mountains, March 30, 1905, *Wooton* (U. S. Nat. Herb.); Tortugas Mountain, Mesilla Park, May 6, 1906, *Standley* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Mesilla Valley, Dona Ana County, April 8, 1907, *Wooton & Standley* (Mo. Bot. Gard. Herb.); near the Cueva, Organ Mountains, April 25, 1907, *Wooton & Standley* (U. S. Nat. Herb.); Carrizallito Mountains, April 20, 1892, *Mearns 3* (U. S. Nat. Herb.).

Utah: Barton's Range, San Juan County, July 16, 1895, *Eastwood 8* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); canyon above Tropic, May 28, 1894, *Jones 5302a* (U. S. Nat. Herb.).

Arizona: Andrade, March 13–April 23, 1903, *Griffiths 4074* (Mo. Bot. Gard. Herb.); Holbrook, Oct. 9, 1897, *Zuck* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Holbrook, July 30, 1896, *Zuck* (U. S. Nat. Herb.); Holbrook, 1901, *Hough 59* (U. S. Nat. Herb.); 5 miles northeast of Holbrook, June 20, 1901, *Ward* (U. S. Nat. Herb.); near Springerville, June 25, 1892, *Wooton* (U. S. Nat. Herb.); rocky slopes near Douglas, May, 1907, *Goodding 2228* (Rky. Mt. Herb.); rocky slopes, Mule Mountains, Bisbee, April, 1909, *Goodding 74* (Rky. Mt. Herb.).

Mexico:

Coahuila and Nuevo Leon: Feb. to Oct., 1880, *Palmer 31* (U. S. Nat. Herb.).

Nuevo Leon: mountains west of Icamole, Feb. 3, 1907, *Safford 1261* (U. S. Nat. Herb.).

Coahuila: Agua Nueva, April 18, 1905, *Palmer 558* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); vicinity of Saltillo, May, 1898, *Palmer 1821½* (U. S. Nat. Herb.); Sierra de Parras, March, 1905, *Purpus 1025* (Baker Herb. at Pomona College, and Mo. Bot. Gard. Herb.); Sierra de la Paila, Oct., 1910, *Purpus 4926* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Oro, Aug. 18, 1903, *Rose & Painter 6430* (U. S. Nat. Herb.); La Ventura, Aug. 2–5, 1896, *Nelson 3919* (U. S. Nat. Herb.); Agua Nueva, Feb. 14, 1847, *Gregg 91* (Mo. Bot. Gard. Herb.); Buena-vista, Feb. 19, 1847, *Gregg 304* (Mo. Bot. Gard. Herb.).

Chihuahua: St. Diego, April 10, 1891, *Hartman 615* (U. S. Nat. Herb.); Santa Eulalia Mountains, March 29, 1885, *Pringle 176* (U. S. Nat. Herb.).

Zacatecas: near Concepcion del Oro, Aug. 11–14, 1904, *Palmer 277* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Hacienda de Cedros, 1908, *Lloyd 236* (U. S. Nat. Herb.).

*L. Fendleri* is certainly the most polymorphic species in this genus and yet there seem to be no natural lines of cleavage along which the species may be separated even varietally. Some strikingly different forms occur and it is possible to sort any considerable number of specimens into several distinguishable groups. If these groups are examined, however, the repre-



sentatives will be seen to have come from no particular part of the range of the species and several forms may be found from the same locality. This has been interpreted to mean that the forms are but ecological variants or represent minor races that occur independently again and again within the taxonomic species. One of the most marked of these forms has been given the specific name of *praecox*. This was first named the variety  $\gamma$ , *humilis* by Gray and is characterized by its low habit of growth, the shortened inflorescence, and the long-pedicelled flowers which are usually exceeded by the leaves. Hartman's collection from Chihuahua is the most aberrant specimen seen, and if future collections of this form are made from the same locality it would seem worthy of varietal rank. In this plant the pedicels are slightly sigmoid and the flowers red. The stellae, however, are quite normal for the species.

The most useful character in determining this species is found in the stellae. The entire plant has a silvery appearance due to the crowded scale-like or scurfy indument. Only *L. Schaffneri* and *L. pueblensis* of the glabrous podded forms have similar stellae and by careful comparison these can be differentiated by the form of the stellae alone. The chief differences between them lie in the pedicels, however. *L. Fendleri* seems to be without close relatives. Because of the unbranched rays of the scales it seems to be allied to the *argyrea-Schaffneri* group.

16. *L. Schaffneri* Wats. Proc. Am. Acad. 23: 254. 1888.

*Vesicaria Schaffneri* Wats. Proc. Am. Acad. 17: 320. 1882.

Perennial, silvery stellate throughout, rays numerous, mostly simple, united nearly or quite to their apices and under a lens appearing as small circular scales; stems simple or branched, erect or decumbent, 1-4 dm. long; terminal bud apparently developing into a normal, fertile stem; radical leaves narrowly oblanceolate, entire, repand or lyrate-pinnatifid, 2-6 cm. long, narrowed to a slender petiole; cauline leaves broadly oblanceolate to nearly linear, entire, repand or with a few prominent teeth, obtuse or acute, 1-3 cm. long, narrowed to a slender petiole; petals narrowly spatulate, about 7 mm. long, yellow, fading purplish (?) ; filaments slightly broadened at the base; fruiting inflorescence elongated; pedicels distinctly sigmoid, 7-10 mm.



long; pods erect, substipitate, glabrous, subglobose or oblong, 3-4 mm. in diameter; styles 2-3 mm. long; septum nerved, areolae rectangular, boundaries frequently tortuous; ovules 6-8 in each cell, funiculi attached to septum for about one-half their lengths; seeds small, marginless.

Distribution: in the mountains of north central Mexico.

Specimens examined:

Mexico:

Coahuila and Nuevo Leon: without definite locality, Feb.-Oct., 1880, *Palmer 29* (U. S. Nat. Herb.).

Coahuila: Sierra de Parras, March to April, 1905, *Purpus 1148* (Baker Herb. at Pomona College, and Mo. Bot. Gard. Herb.).

San Luis Potosi: chiefly in the region of San Luis Potosi, 1878, *Parry & Palmer 26* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); chiefly in the region of San Luis Potosi, 1878, *Parry & Palmer 25½* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); San Luis Potosi, 1879, *Schaffner 555* (U. S. Nat. Herb.); Minas de San Rafael, June, 1911, *Purpus 5232* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

This characteristic Mexican species is probably related most closely to *L. argyrea* and may be distinguished from all other members of the genus by the scale-like stellae in which the rays are attached nearly or quite to their apices.

#### 17. *L. pueblensis* Payson.<sup>1</sup>

Perennial, caudex usually branching and often elongated and woody; stellae numerous, giving the entire plant a silvery appearance, rays unbranched, united for about one-half their lengths, somewhat granular; stems mostly erect, 1-3.5 dm. long, slender, frequently branched; terminal bud apparently usually developing only a short sterile shoot; radical leaves unknown; cauline leaves narrowly oblanceolate, obtuse or acute, entire or repandly dentate, 2-4 cm. long; flowers small, inconspicuous; petals apparently at first yellow, fading purplish, broadly spatulate, about 6 mm. long; filaments linear, point of

<sup>1</sup>*Lesquerella pueblensis* sp. nov., subherbacea vel distincte fruticosa; foliis radicalibus ignotis; foliis caulibus oblanceolatis, integris vel repando-dentatis, lepidostellatis; racemis fructiferis elongatis; pedicellis recurvatis; siliculis globosis, glabris, estipitatis, circiter 4 mm. diametro; loculis 2-3-ovulatis; stylis 1-2 mm. longis; funiculis septo adnatis; seminibus immarginatis.—Type collected in the vicinity of San Luis Tultitlanapa, Puebla, Mexico, by C. A. *Purpus 3389* (Mo. Bot. Gard. Herb.).

attachment slightly enlarged; fruiting inflorescence elongated, pedicels recurved, less than 1 cm. long; pods pendent, sessile, glabrous, globose, about 4 mm. in diameter; styles 1-2 mm. long; septum rather dense, nerved, areolae not tortuous; ovules 2-3 in each cell, funiculi short, attached to septum for about one-half their lengths; seeds not strongly flattened nor winged.



Fig. 13. *L. pueblensis*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

Distribution: State of Puebla, Mexico.

Specimens examined:

Mexico:

Puebla: collected in the vicinity of San Luis Tultitlanapa, near Oaxaca, July, 1908, *Purpus* 3389 (Mo. Bot. Gard. Herb., TYPE, and U. S. Nat. Herb.); near Tehuacan, Aug. 30-Sept. 8, 1905, *Rose, Painter & Rose* 10027 (U. S. Nat. Herb.).

This species is quite similar in appearance to *L. Schaffneri* and a casual comparison might fail to separate them. *L. Schaffneri* normally seems to develop a rosette, while the other plant does not; the rays of the stellae in *L. pueblensis* are free for about half their lengths, but in the related plant they are united nearly or quite to their apices; in *L. Schaffneri* the pedicels are usually sigmoid and the pods erect, in *L. pueblensis* the pedicels are recurved and the pods pendent. The ranges of the two species, as far as collections made up to the present time show, are well separated. *L. pueblensis*, so far as now known, is the southernmost North American species of the genus.

18. *L. recurvata* (Engelm.) Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>st</sup>: 119. 1895; Heller, Contr. Herb. Franklin & Marshall College 1: 40. 1895; Small, Fl. Southeastern U. S. 470. 1903, ed. 2, 470. 1913.

*Vesicaria angustifolia* vars.  $\gamma$ . *longistyla integrifolia* and  $\delta$ . *longistyla pinnatifida* Scheele, *Linnaea* 21: 584. 1848; Roemer, Texas, 436. 1849.

*V. recurvata* Engelm. ex. Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 147. 1850; Walp. Ann. 2: 38. 1851.

*Alyssum recurvatum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Slender annuals, sparsely stellate; stellae scarcely contiguous, small, rays distinct, variable as to number and mode of branching; stems many, branching, erect or decumbent, 1-3.5 dm. long; terminal bud giving rise to a fertile stem; radical leaves thin, 2-4 cm. long, entire, shallowly toothed or rarely nearly lyrate, oblanceolate, narrowed to a slender petiole; cauline leaves entire, oblanceolate to nearly linear; petals yellow, narrowly spatulate, 5-6 mm. long; filaments linear, not dilated at the base; fruiting inflorescence elongated; pedicels very slender, recurved, 1 cm. or less long; pods pendent, sessile or nearly so, glabrous, globose, 2-4 mm. in diameter; styles slender, about as long as the pods; septum thin, nerved about half its length, areolae somewhat tortuous; ovules usually 5 in each cell, funiculi attached to septum for one-half their lengths or less.

Distribution: across central Texas from north to south.

Specimens examined:

Texas: dry soil, west of Crosstimbers, Johnson County, April, 1882, *Reverchon* (Mo. Bot. Gard. Herb.); light soil, Somerville County, April, *Reverchon* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); rocky soils, Falls Creek, Hood County, April, 1885, *Reverchon* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Waco, *Pace 55* (Mo. Bot. Gard. Herb.); cultivated soil, Georgetown, Jan., 1890, *Bodin 63* (U. S. Nat. Herb.); rocky hill, Austin, May 20, 1872, *Hall 20* (U. S. Nat. Herb. and Mo. Bot.



Fig. 14. *L. recurvata*. Habit sketch  $\times \frac{1}{3}$ . Trichomes  $\times 25$ .

Gard. Herb.); dry soil, Austin, April 17, 1903, *Biltmore Herb.* 6966a (U. S. Nat. Herb.); Willow Creek, Gillespie County, *Jermy* (Mo. Bot. Gard. Herb.); Jim Creek, Gillespie County, *Jermy* (U. S. Nat. Herb.); Grape Creek, Gillespie County, *Jermy* (U. S. Nat. Herb.); limestone hills, Menard, Menard County, May 10, 1917, *Palmer 11861* (Mo. Bot. Gard. Herb.); high limestone hills, Blanco, Blanco County, April 15, 1917, *Palmer 11583* (Mo. Bot. Gard. Herb.); Kerrville, Kerr County, April 25-30, 1894, *Heller 1657* (U. S. Nat. Herb., Rky. Mt. Herb., and Mo. Bot. Gard. Herb.); dry limestone hilltops, Kerrville, Kerr County, May 30, 1916, *Palmer 9951* (Mo. Bot. Gard. Herb.); along the Cibolo between New Braunfels and Bexar, May, 1846, *Lindheimer 8* (Mo. Bot. Gard. Herb.); stony prairies, among grass, New Braunfels, April, 1848, *Lindheimer 330* (Mo. Bot. Gard. Herb.); Bexar County, June, 1904, *Jermy* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); near San Antonio, March, 1846, *Lindheimer 12* (Mo. Bot. Gard. Herb.); San Antonio, *Wilkinson 101* (Mo. Bot. Gard. Herb.); San Antonio, *Jermy* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); San Antonio, March 16, 1900, *Canby 25* (U. S. Nat. Herb.); San Antonio, March 16, 1900, *Trelease* (Mo. Bot. Gard. Herb.); stony hills near San Antonio, April 4, 1901, *Eggert* (Mo. Bot. Gard. Herb.); common in barrens, San Antonio, March 23, 1902, *Bush 1170* (Mo. Bot. Gard. Herb.); San Antonio, April 27, 1911, *Clemens 807* (Mo. Bot. Gard. Herb.).

*L. recurvata* is a characteristic species with no very closely related forms. Normally it is an extremely slender plant with nearly filiform stems and pedicels. On technical characters it may be confused with *L. aurea*, but because of the latter's coarse habit of growth the two are of quite different appearance. Their ranges are widely separated. *L. recurvata* comes from a region where the soils are predominantly rich in lime, and some of the specimens examined were labeled to the effect that they grew upon calcareous soil. Its range lies within the lower austral life zone of Merriam.

19. *L. pallida* (Torr. & Gray) Wats. Proc. Am. Acad. 23: 253. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 119. 1895; Small, Fl. Southeastern U. S. 470. 1903, and ed. 2, 470. 1913.

*Vesicaria grandiflora* Hook. var.  $\beta$ . *pallida* Torr. & Gray, Fl. N. Am. 1: 101. 1838; Walp. Rep. 1: 141. 1842.

*V. pallida* Torr. & Gray, Fl. N. Am. 1: 668. 1840; Walp. Ann. 2: 39. 1851.

*Alyssum pallidum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Annual; stem slender, decumbent, much branched, sparingly pubescent, about 3 dm. long; leaves narrowed at the base, rather coarsely toothed, an inch in length; flowers almost white; calyx copiously hairy, sepals elliptical-oblong; pods globose, scarcely stipitate; septum veinless; ovules 6 in each cell.

Distribution: small prairies near St. Augustine, Texas.

No confirmation of this species has been had since the type was collected, and the plant may not differ essentially from *L. recurvata*. In this case the name *pallida* must replace *recurvata* because of priority. This would certainly be most unfortunate since the latter name is so characteristic and so widely accepted for that species. Because *pallida* may prove amply distinct from *recurvata* and the author would deplore the replacing of that name by an unfamiliar one unless absolutely necessary, the present species is maintained. The description is compiled from the original publication in Torrey and Gray's 'Flora' 1: 101. 1838.

20. *L. aurea* Wooton, Bull. Torr. Bot. Club 25: 260. 1898; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915.

Annual; rather loosely stellate throughout; stellae rather few-rayed, rays distinct; stems several to many, erect or decumbent, simple or branched, 2.5–4 dm. long; terminal bud developing into a fertile stem; radical leaves usually absent in mature specimens, about 3 cm. long, blade suborbicular, toothed, narrowed abruptly to a toothed petiole; cauline leaves numerous, oblanceolate, entire or shallowly toothed, usually obtuse, 1–3 cm. long; petals narrowly spatulate, yellow, about 6 mm. long; filaments linear; fruiting inflorescence elongated; pedicels recurved, .8–1.5 cm. long; pods pendent, sessile, glabrous or sparsely pubescent, globose or slightly elongated, 3–4 mm. in diameter; styles 2–3 mm. long; septum thin, faintly nerved half way from apex

to base, areolae not tortuous; ovules 2 in each cell, funiculi attached to septum for about only one-fourth their lengths.

Distribution: in the mountains of southern New Mexico.

Specimens examined:

New Mexico: White Mountains, Lincoln County, July 30, 1897, *Wooton* 245 (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.); Tularosa Creek, Lincoln County, Aug. 18, 1899, *Wooton* (U. S. Nat. Herb.); Clouderoft, Aug. 24, 1901, *Wooton* (U. S. Nat. Herb. and Rky. Mt. Herb.); vicinity of Clouderoft, Aug. 8, 1899, *Wooton* (U. S. Nat. Herb.); Sacramento Mountains, Aug. 7, 1905, *Wooton* (U. S. Nat. Herb.); Luna, July 28, 1900, *Wooton* (U. S. Nat. Herb.); White Mountains, Lincoln County, Aug. 18, 1899, *Wooton* (Deam Herb.).

*L. aurea* in technical characters does not differ greatly from *L. recurvata* but is quite a different plant in general appearance due to its coarse, weedy habit of growth. The number of ovules is reduced to 2, the basal leaves apparently are not so frequently, if at all, pinnate, and the pods instead of being definitely globose are often elongated, rather thin-walled, and irregularly inflated. Specimens from the same locality show glabrous and stellate pods on different plants. Wooton and Standley record it as occurring in the transition zone.

21. *L. argentea* (Pursh) MacMillan, Metasp. Minn. Valley, 263. 1892; Rydb. Contr. U. S. Nat. Herb. 3: 150. 1895; Britton & Brown, Ill. Fl. 2: 137. 1897, and ed. 2, 2: 155. 1913; Rydb. Mem. N. Y. Bot. Gard. 1: 179. 1900; Rydb. Fl. Colo. 155. 1906; Robinson & Fernald in Gray, Manual, ed. 7, 424. 1908; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 218. 1909; Gleason, Bull. Ill. State Lab. Nat. Hist. 9: 48. 1910; Petersen, Fl. Nebr. 62. 1912; Clements & Clements, Rocky Mountain Flowers, 25, 1914. Bergman, Fl. North Dakota, 191. 1918.

*Myagrum argenteum* Pursh, Fl. Am. Sept. 2: 434. 1816.

*Alyssum ludovicianum* Nutt. Gen. N. Am. Pl. 2: 63. 1818.

*Vesicaria ludoviciana* DC. Syst. 2: 297. 1821; Torr. & Gray, Fl. N. Am. 1: 101. 1838; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 149. 1850; Porter & Coulter, Syn. Fl. Colo. 7. 1874;



Macoun, Cat. Canadian Pl. 1: 54. 1883; Coulter, Manual Rocky Mountain Region, 25. 1885; Kellerman, Fl. Kan. 24. 1888.

*Lesquerella ludoviciana* (Nutt.) Wats. Proc. Am. Acad. 23: 252. 1888; Webber, Cat. Fl. Nebr. 119. 1890; Eastwood, Fl. Denver, 6. 1893; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 118. 1895; Nelson, Wyo. Exp. Sta. Bull. 28: 82. 1896; Rydb. Fl. Rocky Mountains, 333. 1917.

*Alyssum globosum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Stout perennial, densely stellate-pubescent throughout; stellae rather large, many-rayed, rays forking near the base, frequently granular; stems erect or decumbent, 2-4 dm. long, usually unbranched; terminal bud remaining undeveloped or central stem elongating slightly but always sterile; radical leaves broadly linear to narrowly oblanceolate, 3-10 cm. long, entire or slightly toothed; cauline leaves similar but shorter, numerous; petals yellow, very narrow, blade and claw scarcely distinct, about 8 mm. long; filaments slightly but gradually dilated at the base; fruiting inflorescence elongated; pedicels recurved, 1-1.5 cm. long; pods usually pendent, sessile or substipitate, globose or slightly elongated, 3-4 mm. in diameter, densely pubescent with more or less spreading stellae; styles slender, equalling or exceeding the pods; septum thin, distinctly nerved, areolae straight or somewhat tortuous; ovules 4-6 in each cell, funiculi attached to septum for about one-half their lengths.

Distribution: Illinois, Minnesota, North and South Dakota, Montana, southern Wyoming, Colorado, eastern Utah, and northern Arizona.

Specimens examined:

Illinois: on sand dunes, Havana, Aug. 22, 1904, *Gleason* (Deam Herb.).

North Dakota: sandy soil on hillside, Cannon Ball, June 28, 1912, *Bergman* 1875 (Mo. Bot. Gard. Herb.); Mandan, 1915, *Sarvis* 6 (U. S. Nat. Herb.).

South Dakota: common at Fort Pierre, June 19, 1853, *Hayden* (Mo. Bot. Gard. Herb.); Eaglenest Butte, on White River, May 14, 1855, *Hayden* (Mo. Bot. Gard. Herb.); bed of Cheyenne River, July 3, 1859, *Hayden* 88 (Mo. Bot. Gard. Herb.);

gravelly places on Eaglenest Butte, Washabaugh County, May 30, 1914, *Over 2005* (U. S. Nat. Herb.); Edgemont, Fall River County, June 2, 1897, *Stanton* (Mo. Bot. Gard. Herb.); Crook, Harding County, July 23, 1910, *Visher 176* (Rky. Mt. Herb.).

Nebraska: Cheyenne County, June 8, 1901, *Baker* (Mo. Bot. Gard. Herb.); Long Pine, June 1, 1899, *Bates* (Rky. Mt. Herb.); Wiegand, July 8, 1893, *Clements 2693* (U. S. Nat. Herb.); Sidney, May 14, 1914, *Eggleston 9030* (U. S. Nat. Herb.); Hershey, May 12, 1903, *Mell* (U. S. Nat. Herb.); on sand hills, Halsey, June 2, 1903, *Mell & Knopf* (Mo. Bot. Gard. Herb.); Long Pine, May 20, 1893, *Rutter* (U. S. Nat. Herb.); hills, Deuel County, June 25, 1891, *Rydberg* (U. S. Nat. Herb.); sand hill, Middle Loup River near Thedford, Thomas County, June 17, 1893, *Rydberg 1281* (U. S. Nat. Herb.); Pine Ridge, June 27, 1899, *Webber* (Mo. Bot. Gard. Herb.); Belmont, July 25, 1889, *Webber* (Mo. Bot. Gard. Herb.); Pine Ridge, June 18, 1890, *Williams 333* (U. S. Nat. Herb.); Platte River, June 18, 1890, *Williams 46* (Rky. Mt. Herb.); Belmont, June 17, 1890, *Williams* (U. S. Nat. Herb.).

Kansas: gravelly soil, Logan County, May 9, 1895, *Hitchcock 16* (Mo. Bot. Gard. Herb., U. S. Nat. Herb., and Rky. Mt. Herb.).

Montana: Great Falls, June 9, 1885, *Williams 5* (U. S. Nat. Herb.); mouth of Sand Coulee, May 28, 1885, *Anderson* (U. S. Nat. Herb.).

Wyoming: plateau east of Cheyenne, June 25, 1880, *Engelmann* (Mo. Bot. Gard. Herb.); gravelly hills near Red Buttes, May 10, 1860, *Hayden* (Mo. Bot. Gard. Herb.); Tie Siding, June 26, 1919, *Osterhout 5914* (Geo. Osterhout Herb.); sterile hills, Yellowstone, 1853-4, *Hayden* (Mo. Bot. Gard. Herb.); Lance Creek, July 4, 1896, *Knowlton 134* (U. S. Nat. Herb.); Laramie, June 17, 1895, *Nelson 1310* (Mo. Bot. Gard. Herb., U. S. Nat. Herb., and Rky. Mt. Herb.); university campus, Laramie, June, 1898, *Nelson 59* (U. S. Nat. Herb.); Laramie, June 1, 1894, *Nelson 190* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Pratt, Laramie County, June 27, 1901, *Nelson 8284* (Mo. Bot. Gard. Herb., U. S. Nat. Herb., and Rky. Mt. Herb.);

common on the plains, Laramie, June 1, 1894, *Nelson 3949* (Rky. Mt. Herb.); open dry flats, Laramie, June 20, 1900, *Nelson 7275* (Rky. Mt. Herb., Mo. Bot. Gard. Herb., Geo. Osterhout Herb., and U. S. Nat. Herb.); Laramie River, June 15, 1891, *Buffum 61* (Rky. Mt. Herb.); railroad grade, Rock River, June 18, 1901, *Goodding 26* (Rky. Mt. Herb.); Fort Steele, Carbon County, May 25–June 10, 1901, *Tweedy 4489* (U. S. Nat. Herb.); T. B. Ranch, Carbon County, June 20, 1901, *Goodding 56* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); dry soil near Washington Ranch, June 30, 1901, *Merrill & Wilcox 733* (U. S. Nat. Herb. and Rky. Mt. Herb.); dry soil 35 miles north of Point of Rocks, June 21, 1901, *Merrill & Wilcox 521* (Rky. Mt. Herb.); Fort Bridger, July, 1873, *Porter* (U. S. Nat. Herb.); Carter, June 25, 1896, *Jones* (U. S. Nat. Herb., Mo. Bot. Gard. Herb., and Rky. Mt. Herb.).

Colorado: Clear Creek, June, 1873, *Wolfe* (U. S. Nat. Herb.); Rocky Mountains, lat. 40–41°, 1868, *Vasey 47* (Mo. Bot. Gard. Herb.); Livermore, Larimer County, July 25, 1904, *Osterhout 2864* (Geo. Osterhout Herb.); Livermore, Larimer County, May 27, 1919, *Osterhout 5888* (Geo. Osterhout Herb.); Sterling, Logan County, June 10, 1896, *Osterhout 1103* (Geo. Osterhout Herb.); Windsor, Weld County, June 6, 1896, *Osterhout 1102* (Geo. Osterhout Herb.); Hugo, June 12, 1907, *Marsh* (U. S. Nat. Herb.); Crow Creek, June 26, 1896, *Knowlton 94* (U. S. Nat. Herb.); Evans, June 1, 1908, *Johnston 164* (Mo. Bot. Gard. Herb.); lat. 41°, 1862, *Hall & Harbour 48* (Mo. Bot. Gard. Herb.); Denver, July, 1884, *Ball* (U. S. Nat. Herb.); north of Craig, Routt County, June 10, 1902, *Osterhout 2621* (Geo. Osterhout Herb.); upper juniper area, west of Delta, June 6, 1909, *Tidesrom 2176* (U. S. Nat. Herb.).

Utah: Pahria Canyon, May 26, 1894, *Jones 5297a* (U. S. Nat. Herb.).

Arizona: 1869, *Palmer* (U. S. Nat. Herb.).

This species has a most interesting geographic distribution. East of the mountains from Montana to south-central Colorado it is a common plant, as it also is in southern Wyoming. Its southern extension to Arizona, however, is marked by very few collections. These collections are quite typical and evidently

the species does occur rarely west of the Continental Divide. It would seem that the comparatively low break in the north and south line of the Rockies that occurs across southern Wyoming made possible the migration of this species far from its point of origin.

The record from Illinois by Gleason is the most remarkable extension of range known for any species of *Lesquerella*. The single plant collected is fragmentary and imperfect owing to the season being so far advanced at the time that the collection was made. Collections made early in the summer may show characters not possessed by this specimen, but at present there seems no reason to regard it other than typical *argentea*. The plants occur "in considerable numbers" on sand dunes about twelve miles northeast of Havana.

From *L. recurvata* and *L. aurea*, this species is separated by its perennial habit of growth and its densely stellate pods. From *L. macrocarpa* and *L. purpurea*, with which it may also be confused because of the recurved pedicels, it is distinguished by the narrow basal leaves. A few specimens have been seen in which the pedicels were straight and ascending but this is evidently a rare variation.

22. *L. arenosa* (Richards.) Rydb. Bull. Torr. Bot. Club 29: 236. 1902; Rydb. Fl. Rocky Mountains, 333. 1917; Bergman, Fl. North Dakota, 191. 1918.

*Vesicaria arenosa* Richards. Franklin's Journey to the Shores of the Polar Sea, 743. 1823; DC. Prodr. 1: 160. 1824.

*V. arctica* Hook. Bot. Mag. 3: t. 2882. 1829.

*V. arctica* var.  $\beta$ . Torr. & Gray, Fl. N. Am. 1: 100. 1838; Hook. Fl. Bor. Am. 1: 48. 1840.

*V. ludoviciana* Macoun, Cat. Canadian Pl. 1: 54. 1883.

*Lesquerella ludoviciana* (Nutt.) Wats. var. *arenosa* Wats. Proc. Am. Acad. 23: 252. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 118. 1895.

*L. argentea arenosa* Rydb. Contr. U. S. Nat. Herb. 3: 485. 1896.

*L. versicolor* Greene, Pittonia 4: 310. 1901; Rydb. Fl. Rocky Mountains, 333. 1917.

*L. Macounii* Greene, Pittonia 4: 310. 1901; Rydb. Fl. Rocky Mountains, 333. 1917.

*L. rosea* Greene, Pittonia 4: 311. 1901; Rydb. Fl. Rocky Mountains, 333. 1917.

*L. Lunellii* Nelson, Bot. Gaz. 42: 49. 1906.

*L. Lunellii* var. *lutea* Nelson, Bot. Gaz. 54: 149. 1912.

Perennial, stellate pubescent throughout, rays long, usually forked near base, irregular; stems slender, decumbent, occasionally branching, .5-2.5 dm. long, terminal bud remaining undeveloped; radical leaves usually rather thin, 1-6 cm. long, blade narrowly oblanceolate to oval, entire or remotely dentate, usually narrowed into a slender petiole; cauline leaves linear to oblanceolate, entire, .5-4 cm. long; petals narrow, about 7 mm. long, yellow or variously tinged with red or purple; stamens filiform; fruiting inflorescence elongated; pedicels slender, recurved or horizontal, 1 cm. or less long; pods globose or slightly elongated, pendent or nearly horizontal, sessile, stellate-pubescent, about 3 mm. in diameter; styles slender, 3-5 mm. long; septum thin, nerved, areolae somewhat tortuous; ovules 4-7 in each cell, funiculi attached to septum for about half their lengths; seeds, small, not margined.



Fig. 15. *L. arenosa*. Habit sketch  $\times \frac{1}{2}$ . Trichomes  $\times 25$ .

Distribution: southern Manitoba, Saskatchewan and Alberta, North and South Dakota, and probably eastern Montana.

Specimens examined:

Manitoba: Stony Mountain, June 4, 1896, *Macoun 12401* (U. S. Nat. Herb.).

Saskatchewan: bluffs, Moose Jaw, June 22, 1907, *Cowles 62* (Mo. Bot. Gard. Herb.).

Alberta: Medicine Hat, June 1, 1894, *Macoun* (U. S. Nat. Herb.); dry hills, Elbow River Valley, vicinity of Calgary, April 25, 1915, *Moodie 810* (U. S. Nat. Herb.).

North Dakota: on gravelly, hilly plains, Dunseith, Rolette County, June 3, 1911, *Lunell* (Rky. Mt. Herb.); stony barren summits of hills, Butte, Benson County, May 14-June 4, 1905, *Lunell* (U. S. Nat. Herb. and Rky. Mt. Herb.); Leeds, Benson County, June 5, 1909, *Lunell* (Rky. Mt. Herb.); Leeds, Benson County, May 28, 1901, *Lunell* (Rky. Mt. Herb.); railroad banks, Leeds, June 10, 1899, *Lunell* (U. S. Nat. Herb.); dry hills, Butte, Benson County, May 20-June 10, 1906, *Lunell* (Geo. Osterhout Herb., Deam Herb., U. S. Nat. Herb., and Rky. Mt. Herb.); dry hills, Towner, McHenry County, May 29, 1908, *Lunell* (Geo. Osterhout Herb., U. S. Nat. Herb., Deam Herb., and Rky. Mt. Herb.); on gravelly hills, Minot, Ward County, June 5 and 6, 1909, *Lunell* (Rky. Mt. Herb.); on sunny slopes, Williston, May 2, 1906, *Lunell* (Rky. Mt. Herb.); Dickinson, June 30, 1912, *Wal-dron* 128 (Deam Herb.).

South Dakota: Date, Perkins County, June 15, 1912, *Visher* 571 (Rky. Mt. Herb.); slopes of Cedar Pass, Stanley County, June 6, 1914, *Over* 6268 (U. S. Nat. Herb.); prairie, Newell, May 12, 1913, *Carr* 8 (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); Hot Springs, June 11, 1892, *Rydberg* 533 (U. S. Nat. Herb.).

*L. arenosa* is likely to be confused with no other species except *L. argentea*, and from that it is distinguished chiefly by the very slender stems and the much smaller size. The leaves in *arenosa* are broader in proportion to their length and more frequently toothed than those of *argentea*. The pubescence in the smaller species is less dense than in the larger one. Finally, the ranges of the two, although apparently overlapping to some extent, are in general rather definitely separated. It may be found impossible to retain *L. arenosa* in specific rank and the treatment accorded it by Watson may be ultimately reinstated. No true intermediates have been seen.

The phylogenetic position of this species with relation to *L. argentea* is not clear. The characters separating the two are slight but *L. arenosa* resembles *L. recurvata*, the parental type of this group, more than does *L. argentea*. The geographical position of the two, however, would indicate that *L. arenosa* is derived from *L. argentea* rather than the reverse. Several gregates have been proposed but the differences they represent



seem no more than the variations between individuals. *L. versicolor* is a form in which the pedicels are not recurved and the flowers are tinged with red. *L. rosea* has recurved pedicels and red flowers. Bergman, from field observation, has noticed the color of the flowers in this species to be exceedingly variable.

23. *L. macrocarpa* A. Nelson, Bot. Gaz. 34: 366. 1902; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 218. 1909; Rydb. Fl. Rocky Mountains, 333. 1917.

Perennial, finely stellate-pubescent throughout, rays distinct, branched; stems decumbent or procumbent, .5-2 dm. long, simple or branched, rather stout; terminal bud remaining undeveloped or producing a short, sterile shoot; radical leaves 1-4 cm. long, blade ovate or orbicular, entire or sparingly toothed, abruptly narrowed to a petiole; cauline leaves numerous, ovate to oblanceolate, obtuse, entire, 1-3 cm. long; petals yellow, broadly spatulate, about 7 mm. long; filaments linear; fruiting inflorescence elongated; pedicels stout, recurved, usually less than 1 cm. long; pods pendent, sessile, stellate-pubescent, when fully developed often 6-7 mm. in diameter, valves rather thin and irregularly inflated; styles 1.5-2 mm. long; septum reduced to a narrow margin around the replum, areolae tortuous; ovules 2-4 in each cell, funiculi attached to septum; seeds flattened, not margined, large.

Distribution: known as yet only from Sweetwater County in southwestern Wyoming.

Specimens examined:

Wyoming: naked clay flats and ridges, Bush Branch, Sweetwater County, June 10, 1900, A. Nelson 7081 (Rky. Mt. Herb., TYPE, Mo. Bot. Gard. Herb., and Geo. Osterhout Herb.); dry soil, 45 miles north of Point of Rocks, June 21, 1900, Merrill & Wilcox 568 (U. S. Nat. Herb. and Rky. Mt. Herb.).

This is a quite distinct species apparently of restricted range, having its nearest relative in *L. argentea*. From that species it is amply distinct by the broader leaves, the procumbent instead of erect stems, and the fewer number of ovules in the cells. In all the specimens examined the septum is nearly obsolete, being reduced to a narrow margin within the replum. Bush Ranch is not far from Steamboat Mountain, near the base of which the type was collected.

24. *L. angustifolia* (Nutt.) Wats. Proc. Am. Acad. 23: 253. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Small, Fl. Southeastern U. S. 471. 1903, and ed. 2, 471. 1913.

*Vesicaria angustifolia* Nutt. ex Torr. & Gray, Fl. N. Am. 1: 101. 1838; Walp. Rep. 1: 141. 1842; Dietr. Gen. Pl. 3: 639. 1843.

Biennial?, canescent with scarcely contiguous stellae, stellae small, rays few to many, branched; stems numerous, slender, erect or decumbent, 1-2 dm. high, branched; terminal bud apparently developing into a fertile stem; radical leaves 1-2 cm. long, entire to sublyrate, narrowly oblanceolate, narrowed to a slender petiole; cauline leaves linear to narrowly oblanceolate,



Fig. 16. *L. angustifolia*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

entire, 1-2 cm. long; petals yellow, spatulate, about 5 mm. long; filaments abruptly dilated at the base; fruiting inflorescence short but not crowded; pedicels straight, strongly ascending, slender, 7-8 mm. long; pods erect, subsessile, glabrous, exactly globose, 2-3 mm. in diameter; styles slender, 3-4 mm. long; septum thin, nerved, areolae tortuous; ovules 2 in each cell, funiculi attached to septum less than one-half their lengths; seeds flat, not margined.

Distribution: Arkansas, southwestern Missouri, and probably western Oklahoma.

Specimens examined:

Missouri: Willard, 1887, *Blankinship* (U. S. Nat. Herb.); Greene County, April 30, 1887, *Blankinship* (Mo. Bot. Gard. Herb.); Greene County, June, 1899, *Plank* (Mo. Bot. Gard. Herb.); Springfield, May 7, 1887, *Blankinship* (Mo. Bot. Gard. Herb.).

From *L. gracilis*, with which this species has been confused in herbaria, it is at once separable by the numerous slender stems that apparently never attain the height reached by *L. gracilis*. The sessile pods, the dilated bases of the filaments, and the few ovules in each cell serve farther to distinguish these

two species. *L. angustifolia* is probably limited to calcareous soils.

25. *L. Lindheimeri* (Gray) Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>st</sup>: 120. 1895; Small, Fl. Southeastern U. S. 470. 1903, ed. 2, 470. 1913.

*Vesicaria Lindheimeri* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 145. 1850; Walp. Ann. 2: 39. 1851.

*Alyssum Lindheimeri* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella Gordonii* Heller, Contr. Herb. Franklin and Marshall College 1: 40. 1895.

Annual or short-lived perennial, canescent throughout with minute stellae, rays few to many, branched, distinct or irregularly coherent; stems erect or decumbent, 1.5–4 dm. long, simple or branched; terminal bud apparently developing a fertile stem; radical leaves usually more densely stellate beneath, lyrate-pinnatifid, oblanceolate, 2–6 cm. long; cauline leaves lanceolate or oblanceolate, conspicuously toothed, 1–3 cm. long; petals yellow, spatulate; filaments slightly enlarged at the base; fruiting inflorescence elongated; pedicels horizontal, more or less sigmoid, 8–13 mm. long; pods erect or ascending, glabrous, subglobose, 4–5 mm. in diameter, stipe 1 mm. or more long; septum nerved, areolae not tortuous; ovules about 8 in each cell, funiculi attached to the septum for about one-half their lengths; seeds not margined nor winged.

Distribution: southern Texas.

Specimens examined:

Texas: black, stiff prairie soil east of Victoria, Feb., 1845, *Lindheimer* 327 (Mo. Bot. Gard. Herb.); along Corpus Christi



Fig. 17. *L. Lindheimeri*. Habitsketch  $\times \frac{1}{8}$ . Trichomes  $\times 25$ .

Bay, Nueces County, March 21, 1894, Heller 1478 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

*L. Lindheimeri*, from an examination of the type collection, seems unquestionably different from any other species of this genus. The failure of other collectors in this same region to get this species again, however, makes its position rather doubtful. The collection by Heller from Corpus Christi is scarcely typical but nearer the species than to *L. Gordonii* and so helps somewhat to confirm *L. Lindheimeri*. The present species is likely to be confused with *L. gracilis* or *L. Gordonii*. From the former the horizontally spreading and sigmoid pedicels separate it and from the latter it may be distinguished by the longer stipe and the more conspicuously pinnatifid leaves. In the type collection the stellae are remote on the upper surface of the leaves and closely overlapping on the lower. They resemble those of *L. gracilis* much more than those of *L. Gordonii*.

26. *L. gracilis* (Hook.) Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 119. 1895; Robinson & Fernald in Gray, Manual, ed. 7, 424. 1908; Britton & Brown, Ill. Fl. 2: 137. 1897, and ed. 2, 2: 155. 1913.

*Vesicaria gracilis* Hook. Bot. Mag. N. S. 10: t. 3533. 1836; Walp. Rep. 1: 141. 1842; Dietr. Syn. Pl. 3: 638. 1843; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 38. 1851.

*V. polyantha* Schlecht. Bot. Zeit. 11: 619. 1853.

*Alyssum gracile* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella polyantha* Small, Fl. Southeastern U. S. 471. 1903, and ed. 2, 471. 1913.

Annual, pubescence stellate, stellae often scarcely contiguous, small, rays numerous, distinct or irregularly coherent; stems many, slender, erect or decumbent, 3-5 dm. long, often branching; terminal bud developing a fertile stem; radical leaves narrowly oblanceolate, 3-8 cm. long, from nearly entire to coarsely lyrate; cauline leaves from linear and entire to oblanceolate and repandly dentate, narrowed at the base, 1-4.5 cm. long; petals yellow, broadly spatulate, about 7 mm. long; filaments linear,

not dilated at the base; fruiting inflorescence elongated, open; pedicels usually straight and ascending, slender, 1-2 cm. long; pods erect or ascending, glabrous, globose to ellipsoid, 3-4 mm. in diameter, borne on a slender stipe 1-2 mm. long; styles slender, 2-3 mm. long, stigma capitate; septum nerved, areolae straight or slightly tortuous; ovules 8-10 in each cell, funiculi attached for about one-half their lengths; seeds not margined, flat.

Distribution: from north to south across central Oklahoma and Texas.

Specimens examined:

Missouri: on the railway bank, Glen Allen, Bollinger County, May, 1900, *Russell* (Mo. Bot. Gard. Herb.).

Oklahoma: Stillwater, April 12, 1897, *Bogue* (U. S. Nat. Herb.).

Texas: Brazos Santiagos, 1889, *Nealley 148* (U. S. Nat. Herb.); fields and waste ground, Dallas, May 19, 1903, *Biltmore Herb. 2693a* (U. S. Nat. Herb.); rich prairies, Dallas, April 14, 1902, *Reverchon 2970* (Mo. Bot. Gard. Herb.); cement works, Dallas County, March 25, 1902, *Reverchon* (Mo. Bot. Gard. Herb.); calcareous soil, Dallas, March 18, 1900, *Reverchon* (Mo. Bot. Gard. Herb.); creek near Dallas, May 3, 1900, *Eggert* (Mo. Bot. Gard. Herb.); light soil, Dallas, April, 1880, *Reverchon 40* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Viewpoint on Ft. Worth & Cleburne Interurban, April 9, 1913, *Ruth 39* (Mo. Bot. Gard. Herb.); prairie near Mustang Creek, Tarrant County, May 11, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Navarro County, 1880, *Joor 93* (U. S. Nat. Herb.); Limestone County, 1878, *Joor 95* (U. S. Nat. Herb.); Waco, *Pace 44* (Mo. Bot. Gard. Herb.); Austin, March 17, 1908, *York 385* (Mo. Bot. Gard. Herb.); dry prairies, Austin, May 18, 1872, *Hall 22* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); common on prairie, Columbia, April 18, 1899, *Bush 186* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); New Braunfels, April, 1850, *Lindheimer 668* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Muskit Flats, New Braunfels, March, 1846, *Lindheimer 331* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Muskit Flats, New Braunfels, May, 1845, *Lindheimer 299* (Mo. Bot. Gard. Herb.); Robstown, Nueces County, April 11, 1905, *Lewton 118* (U. S. Nat. Herb.); Corpus Christi,

March 31, 1905, *Tracy 9196* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Typical *L. gracilis* is characterized by the nearly globose pods borne on long, slender stipes. It is a rather polymorphic and weedy plant and is evidently common in fields and waste places throughout its range. On the north it passes gradually into the variety *repanda*. The one specimen cited for Missouri is typical *gracilis* and represents probably an introduction from farther south, since it was collected upon a railroad embankment and has not been confirmed by other collections from this state. The species and its varieties occur, at least in part, upon calcareous soils.

**26a. Var. *repanda* (Nutt.) Payson, new comb.**

*Vesicaria repanda* Nutt. in Torr. & Gray, Fl. N. Am. 1: 101. 1838; Walp. Rep. 1: 141. 1842; Dietr. Syn. Pl. 3: 639. 1843; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 38. 1851.

*Vesicaria Nuttallii* Torr. & Gray, Fl. N. Am. 1: 101. 1838; Walp. Rep. 1: 141. 1842; Dietr. Syn. Pl. 3: 639. 1843; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850; Walp. Ann. 2: 38. 1851.

*Lesquerella repanda* Wats. Proc. Am. Acad. 23: 252. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 119. 1895; Small, Fl. Southeastern U. S. 470. 1903, and ed. 2, 470. 1913.

*L. Nuttallii* Wats. Proc. Am. Acad. 23: 252. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 119. 1895; Small, Fl. Southeastern U. S. 470. 1903, and ed. 2, 470. 1913.

*Alyssum repandum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*A. Nuttallii* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella gracilis* Petersen, Fl. Nebraska, 62. 1912.

Annual; stems branching; radical leaves sinuate-dentate to lyrate; cauline leaves numerous, repandly dentate; petals yellow; fruiting inflorescence elongated; pedicels horizontal to ascending; pods erect, glabrous, obpyriform, frequently with a distinct shoulder near the base, 5-6 mm. long, borne on a slender stipe 1-2 mm. long; ovules 5-8 in each cell.

Distribution: northeastern Arkansas, southeastern Kansas, Oklahoma, and north central Texas.



## Specimens examined:

Arkansas: in the Cherokee country, between the Illinois and Neosho rivers, June, 1835, *Engelmann* 781 (Mo. Bot. Gard. Herb.).

Kansas: vicinity of Oswego, May 11, 1883, *Oyster* (Mo. Bot. Gard. Herb.); Oswego, May 5, 1891, *Newton* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); low rocky prairie near Independence, April 26, 1902, *Kenoyer* (U. S. Nat. Herb.).

Oklahoma: Goodland, May 10, 1892, *Trelease* (Mo. Bot. Gard. Herb.); common, Catoosa, May 8, 1895, *Bush* 1152 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); grassy prairie, Marietta, Love County, April 18, 1913, *Stevens* 88 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Texas: sandy soil, Terrell, April 5, 1903, *Reverchon* 3716 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

The only consistent difference between this plant and *gracilis* lies in the pear-shaped rather than spherical pods. All intermediates between the two are found. In the specimens cited those plants having globose or ellipsoid pods have been referred to the species and those in which the pods were decidedly pyriform have been retained for the variety. *L. repanda* was described from a plant with immature pods, while in the type of *L. Nuttallii* the pods were fully developed. The shoulder at the base and the broadly pear-shaped apex do not develop until the pod is nearly mature.

26b. Var. *sessilis* Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1<sup>st</sup>: 120. 1895.

*Lesquerella sessilis* Small, Fl. Southeastern U. S. 471. 1903, and ed. 2, 471. 1913.

*Vesicaria angustifolia* Scheele, Linnaea 21: 584. 1848; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 145. 1850; Gray, Smithsonian. Contr. (Pl. Wright.) 5: 13. 1853.

*V. gracilis* Torr. & Gray, Pac. R. R. Rept. 2: 159. 1855.

Annual; stems branching; radical leaves entire to lyrate; cauline leaves linear to oblanceolate, entire or repandly dentate; petals yellow; fruiting inflorescence elongated; pedicels ascend-

ing; pods ascending or erect, sessile, glabrous, globose or slightly elongated, 3-4 mm. in diameter.

Distribution: central to western Texas.

Specimens examined:

Texas: 1851, *Wright* 848 (U. S. Nat. Herb.); Llano Valley, 1888, *Reverchon* 42 (Mo. Bot. Gard. Herb.); Grape Creek, Gillespie County, *Jerry* (Mo. Bot. Gard. Herb.); calcareous open ground, Boerne, Kendall County, April 21, 1917, *Palmer* 11622 (Mo. Bot. Gard. Herb.); summits of hills, New Braunfels, March, 1846, *Lindheimer* 326 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); New Braunfels, May, 1850, *Lindheimer* 301 (Mo. Bot. Gard. Herb.); New Braunfels, May, 1850, *Lindheimer* 669 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Bexar County, June, 1904, *Jerry* (Mo. Bot. Gard. Herb.); rocky soils, San Antonio, March 18, 1903, *Reverchon* (Mo. Bot. Gard. Herb.); light soil, Mackenzie's Well, Crockett County, May, 1888, *Reverchon* 42 (U. S. Nat. Herb.).

This variety occurs with the species throughout its range, and there seems no reason to believe that it is anything more than an occasional variation from the typical form since it differs from the species in but one character—the absence of a stipe to the pod.

27. *L. Gordonii* (Gray) Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1895; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 120. 1895; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915; Armstrong, Western Wild Flowers, 184. 1915; Rydberg, Fl. Rocky Mountains, 333. 1917. *Vesicaria Gordonii* Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 149. 1850; Walp. Ann. 2: 38. 1851.

*Alyssum Gordonii* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Annual, canescent with long-rayed, overlapping stellae, rays distinct, forked at the base; stems 1-3.5 cm. long, decumbent, few to many, branched in the older, more vigorous plants; terminal bud producing either a normal stem or frequently a short stem floriferous nearly to the base; radical leaves 1.5-3.5 cm. long, narrowly oblanceolate or spatulate, acute, tapering to a slender petiole, entire or somewhat repand, rarely lyrate with

two basal lobes; cauline leaves 1–3 cm. long, numerous, linear or narrowly oblanceolate, narrowed at the base, entire or slightly repand; petals yellow, narrowly obovate, claw slightly broadened at the base; filaments linear; fruiting inflorescence elongated; pedicels rather stout, horizontal or somewhat recurved, distinctly sigmoid, about 1 cm. long; pods usually erect, often horizontal, globose, glabrous, about 4 mm. in diameter, stipe evident but less than 1 mm. long; style about 3 mm. long; septum thin, nerved, areolae slightly tortuous; ovules 4–10 in each cell, funiculi long, attached to septum for about one-third their lengths; seeds flat, not margined.



Fig. 18. *L. Gordonii*. Habit sketch  $\times \frac{1}{2}$ . Trichomes  $\times 25$ .

Distribution: western Oklahoma and Texas, southern New Mexico, southeastern Arizona, northern Chihuahua, and Sonora.

Specimens examined:

Oklahoma: Glass Mountains, July 13, 1899, *White 140* (Mo. Bot. Gard. Herb.); Cimarron Valley, Cherokee Outlet, June, 1891, *Carleton 214* (U. S. Nat. Herb.); prairies near Woodward, June 5, 1901, *Eggert* (Mo. Bot. Gard. Herb.).

Texas: west of Cross Timbers, April, 1882, *Reverchon* (Mo. Bot. Gard. Herb.); light soil, Brown County, April, 1882, *Reverchon* (U. S. Nat. Herb.); sandy prairies near Comanche, Comanche County, May 10, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Knickerbocker Ranch, Dove Creek, Tom Greene County, May, 1880, *Tweedy* (U. S. Nat. Herb.); San Angelo, May 19, 1903, *Reverchon* (Mo. Bot. Gard. Herb.); plains west of Pecos, April 20, 1902, *Tracy & Earle 119* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.); sandy ground near Van Horn, May 13, 1901, *Eggert* (Mo. Bot. Gard. Herb.); Rio Grande, 60 miles below El Paso, March, 1852, *Wright 1318* (Mo. Bot. Gard. Herb.); sandy ground near Sierra Blanca, El Paso County, May 13, 1901, *Eggert* (Mo. Bot. Gard. Herb.); Big Springs,

May 11, 1902, *Tracy 8043* (U. S. Nat. Herb.); rocky prairies near Colorado, Mitchell County, June 10, 1900, *Eggert* (Mo. Bot. Gard. Herb.); Grady, Fisher County, March 31, 1901, *Shepherd* (U. S. Nat. Herb.); sandy plains, Estelline, May 24-25, 1904, *Reverchon 4288* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); sandy soil, Amarillo Creek, May 30, 1902, *Reverchon* (Mo. Bot. Gard. Herb.); dry prairies near Canadian, Hemphill County, June 7, 1901, *Eggert* (Mo. Bot. Gard. Herb.).

New Mexico: *Parry, Bigelow, Wright & Schott 44* (U. S. Nat. Herb.); on the upper Canadian in the mountains of New Mexico, April, 1848, *Gordon* (Mo. Bot. Gard. Herb.); Gray, Lincoln County, 1898, *Skehan* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Mesilla Valley, March 31, 1907, *Wooton & Standley* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); near Mesilla, May 4, 1906, *Standley* (U. S. Nat. Herb.); Mesilla Valley, April 26, 1905, *Wooton* (U. S. Nat. Herb. and Deam Herb.); Mesilla Valley, April 24, 1893, *Wooton* (U. S. Nat. Herb.); Lake Valley, April, 1914, *Beals* (U. S. Nat. Herb.); near Silver City, June 2, 1880, *Greene* (Mo. Bot. Gard. Herb.); Mangas Springs, Grant County, April 20, 1903, *Metcalf 23* (Rky. Mt. Herb., U. S. Nat. Herb., and Mo. Bot. Gard. Herb.); Mangas, May, 1897, *Metcalf 48* (U. S. Nat. Herb.); Mangas Springs, Grant County, April 3, 1880, *Rusby 14* (Mo. Bot. Gard. Herb.); Mangas Springs, Sept. 3, 1880, *Rusby 398* (U. S. Nat. Herb.).

Arizona: Andrade, March 13-April 23, 1903, *Griffiths 4091* (U. S. Nat. Herb.); Skull Valley, June 4, 1865, *Coues & Palmer 237* (Mo. Bot. Gard. Herb.); Skull Valley, May 3, 1865, *Coues & Palmer 188* (Mo. Bot. Gard. Herb.); on mesas, Camp Grant, March 10, 1867, *Palmer 10* (Mo. Bot. Gard. Herb.); grassy knolls, common, May 3, 1865, *Coues & Palmer 197* (Mo. Bot. Gard. Herb.); Santa Rosa to Casa Grande, March 13-April 23, 1903, *Griffiths 4011* (U. S. Nat. Herb.); Canaca to Arabaca, March 13-April 23, 1903, *Griffiths 3548* (U. S. Nat. Herb.); vicinity of Duncan, April, 1908, *Rose 11740* (U. S. Nat. Herb.); Santa Catalina Mountains, March, 1881, *Vasey* (U. S. Nat. Herb.); Tucson, 1911, *Beard* (Mo. Bot. Gard. Herb.); hills near Tucson, April, 1880, *Pringle* (U. S. Nat. Herb.); Tumamoc Hill, Tucson, Feb. 28, 1914, *Harris C. 142* (U. S. Nat. Herb.); small range reserve near Tucson, March 13-April 23, 1903,

*Griffiths 3531* (U. S. Nat. Herb.); Tucson, Feb. 20, 1892, *Toumey 66* (U. S. Nat. Herb.); Tucson, March 20, 1894, *Toumey* (U. S. Nat. Herb.); Tucson Mountains, March 13–April 23, 1903, *Griffiths 3493* (U. S. Nat. Herb.); campus, Univ. of Arizona, Tucson, March 14, 1903, *Thorner 369* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Santa Rita Range Reserve, May 19, 1912, *Wooton* (U. S. Nat. Herb.); Santa Rita Forest Reserve, March 31–April 23, 1903, *Griffiths 3905* (U. S. Nat. Herb.); Arivapa Canyon, March, 1873, *Mohr* (U. S. Nat. Herb.).

Mexico:

Chihuahua (?): Carrizallito Mountains, April 19, 1892, *Mearns 5* (U. S. Nat. Herb.).

*L. Gordonii* is a common plant throughout at least a large part of its range and occurs associated with other cruciferous weeds in waste places. Its distinguishing characteristics are the annual root, the sigmoid pedicels, and the shortly stipitate, globose, glabrous pod. Its nearest relative seems to be *L. Palmeri* with which it may be found to merge in Arizona.

28. *L. Palmeri* Wats. Proc. Am. Acad. 23: 255. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 118. 1895.

*L. Gordonii* (Gray) Wats. var. *sessilis* Wats. Proc. Am. Acad. 23: 253. 1888; Coulter, Contr. U. S. Nat. Herb. 2: 18. 1891; Wats. in Gray, Syn. Fl. N. Am. 1': 120. 1895.

*L. tenella* A. Nels. Bot. Gaz. 47: 426. 1909.

Annual, stellae rather small, frequently sparse, rays numerous, forked at base, distinct, finely granular; stems slender, decumbent or erect, 1–4 dm. long, in the larger plants usually branched; terminal bud developing a normal, fertile stem; radical leaves entire to lyrate with few lobes, 1–5 cm. long, narrowed to a slender petiole; cauline leaves linear to oblanceolate, entire or slightly repand, 1–5 cm. long; petals yellow, broadly spat-



Fig. 19. *L. Palmeri*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

ulate, claw somewhat broadened at the base; filaments linear; fruiting inflorescence elongated; pedicels ascending, horizontal or recurved, usually sigmoid, 1 cm. or less long; pods erect, horizontal or, rarely, nearly pendent, sessile, or substipitate, sparsely stellate-pubescent, globose or slightly elongated, 3-5 mm. in diameter; styles 2-3 mm. long; septum nerved, areolae somewhat tortuous; ovules 4-6 in each cell, funiculi attached to septum for about one-half their lengths; seeds flattened, not winged.

Distribution: southern Utah, western Arizona, southeastern Nevada, California, and northern Lower California.

Specimens examined:

Utah: southern Utah, 1875, *Johnson* (U. S. Nat. Herb.).

Arizona: Beaverdam, April 5, 1894, *Jones 5024e* (U. S. Nat. Herb.); mesa north of Phoenix, Feb. 9, 1912, *Wootton* (U. S. Nat. Herb.); Hassayampa Valley, April 12, 1876, *Palmer 570* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Yucca, March 12, 1912, *Wootton* (U. S. Nat. Herb.); Yucca, May 13, 1884, *Jones 3879* (U. S. Nat. Herb.).

Nevada: at base of cliffs, Meadow Valley Wash, April 6, 1905, *Goodding 2155* (Rky. Mt. Herb.); Bunkerville, April 6, 1894, *Jones 5029b* (U. S. Nat. Herb.); among the undershrub, Moapa, April 8, 1905, *Goodding 2184* (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.); Moapa, Lincoln County, May 12, 1905, *Kennedy 1096* (U. S. Nat. Herb.); Vegas Wash, Lincoln County, near its junction with the Colorado River, March 11, 1891, *Coville & Funston 406* (U. S. Nat. Herb.).

California: Canyon Springs, Riverside County, April 22, 1905, *Hall 5845* (Rky. Mt. Herb.); Salvation Springs, Riverside County, April 24, 1905, *Hall 5882* (U. S. Nat. Herb.).

Mexico:

Lower California: Topo Canyon, July 9, 1884, *Orcutt 1099* (Mo. Bot. Gard. Herb.).

. *L. Palmeri* has usually been confused with *Gordonii* from which it is separated by its sparsely stellate, rather than glabrous, and sessile or subsessile, rather than stipitate, pods. It is usually a more slender plant than *L. Gordonii* and the stems seem less inclined to branch. The pedicels are at times recurved and so suggest the *recurvata* group but they nearly always show a noticeable tendency to become S-shaped. This species is



apparently able to survive in a more truly desert region than any other member of the genus. The plants complete their growth and mature their seeds very early in the season.

29. *L. pinetorum* Wooton & Standley, Contr. U. S. Nat. Herb. 16: 126. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 276. 1915.

Perennial, densely stellate throughout, stellae rather small, rays numerous, branched, distinct or somewhat coherent, granular; stems decumbent or erect, 1-2.5 dm. long, simple; terminal bud usually developing a short fertile stem; radical leaves oblanceolate, spatulate or nearly oval, entire or irregularly denticulate, 2-6 cm. long, narrowed to a slender petiole; cauline leaves spatulate to oblanceolate, usually obtuse, entire or denticulate, 1-4 cm. long; petals yellow, narrowly spatulate, 7-10 mm. long; filaments linear; fruiting inflorescence elongated; pedicels distinctly sigmoid, 8-10 mm. long; pods usually erect, glabrous, sessile, globose, 3-5 mm. in diameter; styles 3-5 mm. long; septum nerved, areolae not tortuous; ovules 5-7 in each cell, funiculi attached to septum for less than one-half their lengths; seeds large, flat, not winged.

Distribution: central New Mexico.

Specimens examined:

New Mexico: Sandia Mountains, June, 1898, *Herrick 204* (U. S. Nat. Herb.); dry ridges, Balsam Park, Sandia Mountains, April 7, 1911, *Ellis 7* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); San Mateo Mountains, March 27, 1895, *Herrick 531* (U. S. Nat. Herb.); Kingston, Sierra County, May 2, 1905, *Metcalfe 1534* (Mo. Bot. Gard. Herb.); White Mountain Peak, Aug. 16, 1897, *Wooton* (U. S. Nat. Herb.); vicinity of Gilmore's Ranch, on Eagle Creek, Lincoln County, July 29, 1901, *Wooton* (U. S. Nat. Herb.); White Mountains, Lincoln County, Aug. 25, 1907, *Wooton & Standley 3460* (U. S. Nat. Herb., TYPE).

To *L. pinetorum* is referred a somewhat heterogeneous group



Fig. 20. *L. pinetorum*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

of specimens characterized by glabrous, nearly globose pods, conspicuously sigmoid pedicels, and an imperfect rosette. As to size of the pods, form of the basal leaves, and leafiness of the stem there is considerable variation. The series of specimens at hand is scarcely enough to show whether or not the species should be broken up into two or three varieties, and accordingly the present treatment is regarded as rather provisional. The type is characterized by small pods and numerous stem-leaves.

30. *L. pruinosa* Greene, *Pittonia* 4: 307. 1901.

Perennial, canescently stellate-pubescent throughout, stellae



Fig. 21. *L. pruinosa*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

small, scarcely contiguous on fully developed leaves, many-rayed, rays forked, irregularly coherent; caudex woody, sometimes branched; stems decumbent or erect, 10–17 cm. long, unbranched; terminal bud remaining undeveloped; radical leaves 3–8 cm. long, blade indefinitely quadrate to oval, entire or repand, obtuse, abruptly narrowed to the slender petiole which exceeds it in length, petiole frequently purplish, pruinose with not closely contiguous stellae; cauline leaves obovate, entire or few-toothed, obtuse, 1–2 cm. long; flowers sulphur-yellow, small; fruiting inflorescence elongated, rather crowded;

pedicels conspicuously sigmoid, 5–6 mm. long; pods erect, sessile or subsessile, glabrous, ellipsoid, 6–9 mm. long; styles slender, 4–6 mm. long; septum nerved, entire, areolae conspicuously tortuous; ovules 3–4 in each cell, funiculi attached to the septum for less than one-half their lengths; seeds not margined.

Distribution: southern Colorado.

Specimens examined:

Colorado: Pagosa Springs, Archuleta County, July 4, 1917, Bethel (Geo. Osterhout Herb. and Bethel Herb.).

This species is most closely related to *L. pinetorum* and marks a decided advance in specialization as well as a considerable

step in the northward progression of this line of development. It is definitely separated from *pinetorum* by its conspicuous rosette and broad-bladed radical leaves.

Although the type of *L. pruinosa* has not been seen there seems no doubt that Prof. Bethel's collection from the type locality is specifically identical with it. The only point of difference in Dr. Greene's description and the specimen seen is in the length of the stem. The type is described as having "peduncles and short racemes not greatly surpassing the foliage even in fruit." In Prof. Bethel's plant the fruiting inflorescence is carried well above the tuft of radical leaves.

31. *L. lata* Wooton & Standley, Contr. U. S. Nat. Herb. 16: 126. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915.

Perennial, densely stellate throughout, stellae rather small, rays numerous, branching, granular; stems erect or spreading, about 1 dm. long, simple; terminal bud (in type specimen) giving rise to a very short stem, floriferous to the base; radical leaves 3-4 cm. long, blade entire, obtuse, broadly oval, narrowed to a long slender petiole; cauline leaves broadly oblanceolate, entire, obtuse, 1-2 cm. long; petals yellow, narrowly spatulate, about 7 mm. long; filaments linear; fruiting inflorescence elongated or slightly compacted; pedicels sigmoid, 5-7 mm. long; pods usually erect, sessile, sparsely stellate-pubescent, globose or somewhat obpyriform, 1.5-3 mm. in diameter; styles slender, 3-4 mm. long; septum nerved, areolae not tortuous; ovules 5-6 in each cell, funiculi attached to septum about one-fourth their lengths; seeds not winged.

Distribution: in the White Mountains of southern New Mexico.

Specimens examined:



Fig. 22. *L. lata*. Habit sketch  $\times \frac{1}{8}$ . Trichomes  $\times 25$ .

New Mexico: collected in or near the Lincoln National Forest, 1903, *Plummer* (U. S. Nat. Herb., TYPE); White Mountain Peak, alt. 9600 feet, July 6, 1895, *Wooton* (U. S. Nat. Herb.).

*L. lata*, although known by very few collections, may well stand as a distinct step between the glabrous and stellate podded species of this group. The sparsely pubescent pods distinguish it from *L. pinetorum*, while the broad stem-leaves and the imperfect rosette separate it from *L. rectipes*. In the type specimen the terminal stem is greatly shortened and bears pods nearly to the base. This intermediate step between the species that show no inhibition of the terminal bud and those forming a perfect rosette is most interesting. This character is shared likewise by *L. pinetorum*.

32. *L. rectipes* Wooton & Standley, Contr. U. S. Nat. Herb. 16: 127. 1913; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 217. 1915.

*L. montana* Rydb. Fl. Colo. 155. 1906, in part.



Fig. 23. *L. rectipes*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

Perennial, densely stellate throughout, stellae many-rayed, rays branched, distinct or somewhat coherent, granular; stems decumbent, 1-4 dm. long, usually simple; terminal bud remaining undeveloped; radical leaves from narrowly oblanceolate to ovate, entire or repandly dentate, 2-5 cm. long, narrowed to a slender petiole; cauline leaves linear to narrowly oblanceolate, usually quite entire, 1-3 cm. long; petals yellow, narrowly oblanceolate, about 7 mm. long; filaments linear; fruiting inflorescence frequently showing a tendency to remain crowded near the summit of the stem; pedicels in age usually sigmoid, 8-10 mm. long; pods horizontal to erect, sessile, sparsely stellate-pubescent, globose or slightly elongated, 3-5 mm. in diameter; styles 3-5 mm. long; septum nerved, areolae scarcely tortuous; ovules 3-6 in each cell, funiculi attached to septum for about one-half their lengths; seeds flattened, neither winged nor margined.

Distribution: southwestern Colorado, northwestern New Mexico, southeastern Utah, and northeastern Arizona.

Specimens examined:

Colorado: Mancos, Montezuma County, June 15, 1899, *Osterhout 1947* (Geo. Osterhout Herb.); Mancos, June 24, 1898, *Baker, Earle & Tracy 85* (Rky. Mt. Herb., Geo. Osterhout Herb., Mo. Bot. Gard. Herb., Baker Herb. at Pomona College, and U. S. Nat. Herb.); Los Pinos, May, 1899, *Baker 254* (Baker Herb. at Pomona College, U. S. Nat. Herb., Rky. Mt. Herb., Geo. Osterhout Herb., and Mo. Bot. Gard. Herb.); dry valley lands, Paradox, Montrose County, June 21, 1912, *Walker 150* (Rky. Mt. Herb.); rocky slopes, Paradox, June 22, 1912, *Walker 168* (Rky. Mt. Herb.); dry, stony slopes of hills east of Montrose, June 15, 1915, *Payson 669* (Rky. Mt. Herb.); dry hills, Naturita, May 11, 1914, *Payson 294* (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.).

New Mexico: northwestern New Mexico, June 6, 1883, *Marsh 81* (U. S. Nat. Herb., TYPE); 13 miles south of Atarque de Garcia, July 19, 1906, *Wooton* (U. S. Nat. Herb.); between Salt Lake and Atarque de Garcia, July 19, 1906, *Wooton* (U. S. Nat. Herb.); Navajo Indian Reservation, in the Tunitcha Mountains, Aug. 8, 1911, *Sandley 7787* (U. S. Nat. Herb.); along the Rio Grande, west of Santa Fe, May 31, 1897, *Heller 3634* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Utah: western slope of La Sal Mountains, near Little Springs, July 5-6, 1911, *Rydberg & Garrett 8558* (Rky. Mt. Herb. and U. S. Nat. Herb.); Armstrong and White Canyons, near the Natural Bridges, Aug. 4-6, 1911, *Rydberg & Garrett 9448* (U. S. Nat. Herb. and Rky. Mt. Herb.).

This species is most likely to be confused with *L. montana* and is distinguished from it chiefly by the normally globose pods. The ranges of the two nearly meet in New Mexico but farther north the Continental Divide separates them. The pods in *L. montana* are densely stellate, while the stellae on those of *L. rectipes* are rarely contiguous.

33. *L. montana* (Gray) Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>st</sup>: 117. 1895; Rydb. Fl. Colo. 155. 1906; Nelson in Coulter & Nelson, Manual Cent. Rocky

Mountains, 219. 1909; Nelson, Spring Fl. Intermountain States, 65. 1912; Clements & Clements, Rocky Mountain Flowers, 25. 1914; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915; Rydb. Fl. Rocky Mountains, 332. 1917.

*Vesicaria montana* Gray, Proc. Acad. Nat. Sci. Phila. 1863: 58, 1863; Porter & Coulter, Syn. Fl. Colo. 7. 1874; Coulter, Manual Rocky Mountain Region, 25. 1885.

*Alyssum Grayanum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella rosulata* Nelson, Bull. Torr. Bot. Club 25: 205. 1898.

*L. Shearis* Rydb. Bull. Torr. Bot. Club 29: 237. 1902; Rydb. Fl. Colo. 155. 1906; Daniels, Univ. Mo. Studies 2: 128. 1911; Rydb. Fl. Rocky Mountains, 332. 1917.

*L. curvipes* Rydb. Fl. Colo. 155. 1906; Rydb. Fl. Rocky Mountains, 332. 1917, in part.

Perennial, cinerous stellate-pubescent throughout, stellae few to many-rayed, rays forked near the base, distinct or irregularly coherent; caudex frequently unbranched, rarely enlarged; stems decumbent, 1-2 dm. long, unbranched or rarely branched; terminal bud remaining undeveloped; radical leaves quite variable in outline, 1.5-4 cm. long, entire, narrowly oblanceolate, acute with blade tapering gradually to the petiole or blade ovate to oblong, abruptly narrowed to the slender petiole, entire or toothed, frequently obtuse; cauline leaves from very narrowly oblanceolate to broadly cuneate and then frequently with 2 conspicuous lateral teeth, acute or obtuse, 1-3 cm. long, numerous; petals yellow, narrowly spatulate, 7-9 mm. long; filaments linear, slightly enlarged at point of attachment; fruiting inflorescence elongated; pedicels conspicuously sigmoid, 8-12 mm. long; pods erect, sessile, densely stellate-pubescent, oblong, 6-8 mm. long, obtuse or acute but not conspicuously compressed at the apex; styles 3-6 mm. long; septum conspicuously nerved, areolae straight or tortuous; ovules 6-10 in each cell, funiculi attached to the septum for less than one-half their lengths; seeds not margined.

Distribution: southwestern South Dakota, southeastern Wyoming, eastern Colorado and northeastern New Mexico.

Specimens examined:

South Dakota: Hot Springs, June 6, 1893, *Schneck* (Mo. Bot. Gard. Herb.).



Wyoming: open, sandy plains, Cheyenne, May, 1902, *Nelson 8843* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., and U. S. Nat. Herb.); Cheyenne, June 14, 1916, *Eggleston 12552* (U. S. Nat. Herb.); near Table Mountain, June 2, 1894, *Nelson 3757* (Rky. Mt. Herb.); Table Mountain, June 2, 1895, *Nelson 88* (U. S. Nat. Herb.); Dixon Canyon, May 27, 1890, *Buffum 60* (Rky. Mt. Herb.); Pole Creek, June 29, 1895, *Nelson 1370* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., and U. S. Nat. Herb.); Centennial Valley, Aug. 18, 1896, *Nelson* (Rky. Mt. Herb.); Laramie River, June 29, 1900, *E. Nelson 265* (Rky. Mt. Herb.); stony ridges, Laramie Hills, June 5, 1900, *Nelson 7256* (Mo. Bot. Gard. Herb. and U. S. Nat. Herb.).

Colorado: without definite locality, 1871, *Greene* (Mo. Bot. Gard. Herb.); New Windsor, June, 1895, *Osterhout 4426* (Geo. Osterhout Herb.); New Windsor, June 2, 1908, *Osterhout 3851* (Geo. Osterhout Herb.); Spring Canyon, Larimer County, May, 1895, *Osterhout 785* (Geo. Osterhout Herb.); Fossil Creek, Larimer County, June 25, 1917, *Osterhout 5615* (Geo. Osterhout Herb.); Owl Canyon, Larimer County, May 27, 1919, *Osterhout 5889* (Geo. Osterhout Herb.); Ft. Collins, May 27, 1894, *Baker* (Mo. Bot. Gard. Herb.); Ft. Collins, May 15, 1895, *Baker* (Rky. Mt. Herb.); Ft. Collins, May 15, 1896, *Baker* (Mo. Bot. Gard. Herb.); Ft. Collins, May 19, 1897, *Crandall 212* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Long Canyon and Rist Canyon, May 31, 1896, *Baker & Holzinger 92* (U. S. Nat. Herb.); Estes Park, July, 1884, *Ball* (U. S. Nat. Herb.); Estes Park, July 1, 1912, *Churchill* (Mo. Bot. Gard. Herb.); North Park, 1881, *Broadhead 105* (Mo. Bot. Gard. Herb.); Michigan Creek, North Park, Jackson County, July 31, 1913, *Osterhout 4993* (Geo. Osterhout Herb.); near Boulder, June 3, 1901, *Ramaley 710* (Rky. Mt. Herb.); near Boulder, July, 1902, *Tweedy 5067* (Rky. Mt. Herb.); near Boulder, May 30, 1905, *Ramaley 1027* (Rky. Mt. Herb.); St. Vrain Creek, June 9, 1906, *Dodds 1889* (Rky. Mt. Herb.); Lyons, in foothills, May 24, 1916, *Johnston 850* (U. S. Nat. Herb.); plains near Denver, May 8, 1900, *Rydberg & Vreeland 6137* (Geo. Osterhout Herb.); Clear Creek, June-July, 1873, *Wolfe* (U. S. Nat. Herb.); Middle Mountains, 39-41° lat., 1862, *Hall & Harbour 49* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); plains, Colorado Springs, May 4, 1878,

*Jones 19* (U. S. Nat. Herb.); dry, gravelly soil on hills near Colorado Springs, June 18, 1896, *Biltmore Herb. 2695a* (U. S. Nat. Herb.); east of Garden of Gods, June 22, 1896, *Biltmore Herb. 1292* (U. S. Nat. Herb.); Colorado Springs, May 8, 1897, *Heller 3509* (Mo. Bot. Gard. Herb.); mesas near Colorado Springs, May 9, 1900, *Rydborg & Vreeland 6145* (Rky. Mt. Herb.); vicinity of Colorado Springs, June 19–30, 1915, *Eggleston 11195* (U. S. Nat. Herb.); Canyon City, April 1, 1871, *Brandegee 25* (Mo. Bot. Gard. Herb.); South Park, 1873, *Wolfe 641* (U. S. Nat. Herb.); Arthur's, South Park, June 2, 1910, *Eggleston 5632* (U. S. Nat. Herb.); Salida, June 19, 1898, *Baker, Earle & Tracy 901* (Baker Herb. at Pomona College, and Mo. Bot. Gard. Herb.); Salida, June 27, 1917, *Payson 1017* (Mo. Bot. Gard. Herb.); river bluffs, north of La Veta, May 21, 1900, *Rydborg & Vreeland 6139* (Rky. Mt. Herb.); mountain near La Veta, June 20, 1900, *Rydborg & Vreeland 6141* (Rky. Mt. Herb.).

New Mexico: volcanic hills, on and near the Sierra Grande, Union County, June 18, 1911, *Standley 6054* (U. S. Nat. Herb.); Pecos River, June 6, 1897, *Heller* (U. S. Nat. Herb.).

*L. montana*, although quite a variable species as regards leaf outline, is usually at once distinguishable by the sigmoid pedicels and elongated pods. *L. rosulata* was described from an abnormal plant of a form with broad basal leaves. In Colorado *L. montana* crowds close upon the Continental Divide, but in the typical form seems never to have crossed it. Osterhout's No. 4993 is aberrant because of its shorter, slightly obcompressed pods. If further collections of it are made it would seem worthy of varietal rank.

### 33a. Var. *suffruticosa* Payson.<sup>1</sup>

Caudex enlarged and woody, branching in the older specimens; radical leaves silvery stellate-pubescent, 2–6 cm. long, oblanceolate, blade gradually narrowed to the slender petiole, irregularly dentate or repand, usually acute; pods oblong, 6–8 mm. long; styles 2–6 mm. long; ovules 7–10 in each cell.

Distribution: southern Colorado to northeastern New Mexico.

Specimens examined:

<sup>1</sup> *Lesquerella montana* (Gray) Wats. var. *suffruticosa*, var. nov., caudex amplius, suffruticosus; foliis radicalibus 2–6 cm. longis, oblanceolatis, inaequaliter dentatis vel repandis.—Collected on dry hills on or near the Sierra Grande, Union County, New Mexico, June 20, 1911, *P. C. Standley 6249* (U. S. Nat. Herb.).

Colorado: south of Trinidad, Las Animas County, July 21, 1918, *Osterhout 5781* (Geo. Osterhout Herb.); Trinidad (road to Walsenburg), June 20, 1917, *Johnston 976* (Geo. Osterhout Herb.); Silverton, July 10, 1895, *Tweedy 147* (U. S. Nat. Herb.).

New Mexico: dry hills on and near the Sierra Grande, Union County, June 20, 1911, *Standley 6249* (U. S. Nat. Herb., TYPE); dry hills, vicinity of Raton, Colfax County, June 21 and 22, 1911, *Standley 6294* (U. S. Nat. Herb.).

This variety is characterized by an excessive development of the caudex and by the more silvery, larger basal leaves which are usually toothed. The specimen from Silverton, Colorado, is the only one seen from west of the Continental Divide and is nearly, if not quite, typical.

34. *L. curvipes* A. Nelson, Bull. Torr. Bot. Club 25: 205. 1898; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909; Rydb. Fl. Rocky Mountains, 332. 1917, in part.

Perennial, stellate-pubescent throughout, stellae frequently rather remote, many-rayed, rays distinct or irregularly coherent, forked; stems erect or decumbent, 1-4 dm. long, often branched; terminal bud remaining undeveloped; radical leaves linear-oblongate, the outermost sometimes oval, entire or repand, 3-6 cm. long, acute; cauline leaves linear-oblongate, entire, 2.5-5 cm. long; petals narrowly spatulate, yellow; filaments linear; fruiting inflorescence elongated; pedicels conspicuously sigmoid, 8-15 mm. long; pods erect, sessile, stellate-pubescent, ovate or oblong, distinctly compressed at the apex, 6-8 mm. long; styles 2-4 mm. long; septum nerved, areolae more or less tortuous; ovules 4-6 in each cell, funiculi attached to the septum for about one-half their lengths; seeds not margined, radical turned slightly to one side.



Fig. 24. *L. curvipes*. Habitsketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

Distribution: northern Wyoming and southern Montana.

Specimens examined:

Montana: Red Lodge, July 26, 1893, *Rose* 42 (U. S. Nat. Herb.).

Wyoming: Dome Lake Grade, July 18, 1896, *Nelson* 2424 (Rky. Mt. Herb., TYPE); stony foothills west of Hurlbut Creek, June 15, 1909, *Willits* 94 (Rky. Mt. Herb.); dry slope, hills southeast of Sheridan, June 15, 1913, *Sharp* 339 (Rky. Mt. Herb.); Buffalo, July, 1900, *Tweedy* 3588 (Rky. Mt. Herb.); from seed grown at Laramie, 1899, *Nelson & Nelson* (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.).

*L. curvipes* is closely related to *L. montana* and may be distinguished from it by the pods which are strongly compressed at the apex. It is isolated geographically from *montana* since their ranges are not known to approach one another closely.

35. *L. globosa* (Desv.) Wats. Proc. Am. Acad. 23: 252. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 118. 1895; Britton & Brown, Ill. Fl. 2: 136. 1897, and ed. 2, 2: 154. 1913; Robinson & Fernald in Gray, Manual, ed. 7, 424. 1908; Small, Fl. South-eastern U. S. 470. 1903, and ed. 2, 470. 1913.

*Vesicaria globosa* Desv. Jour. Bot. 3: 184. 1814; Dietr. Syn. Pl. 3: 638. 1843.

*V. Shortii* Torr. & Gray, Fl. N. Am. 1: 102. 1838, supplement, 668. 1840; Walp. Rep. 1: 141. 1842; Dietr. Syn. Pl. 3: 639. 1843; Gray, Bost. Jour. Nat. Hist. (Pl. Lindh.) 6: 148. 1850.

*Alyssum Shortii* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

Biennial or perennial, canescent throughout with a rather loose stellate pubescence; stellae few- to many-rayed, rays forked; caudex somewhat woody, more or less elongated, unbranched; stems many, frequently branched, rather slender, 2.5-5 dm. long; terminal bud developing into a fertile stem; radical leaves 2.5-5 cm. long, oblong, entire or repand-toothed, blade gradually narrowed to the short petiole, strongly veined beneath; cauline leaves nearly linear to lanceolate, entire or repand, 1-4 cm. long, narrowed to a slender base; petals yellow, spatulate, 4-5 mm. long; filaments linear, slightly enlarged at the base; fruiting inflorescence elongated; pedicels slender, nearly straight,

horizontal or ascending, 7-11 mm. long; pods horizontal or ascending, sessile, sparsely stellate-pubescent or glabrous, globose, 1-2 mm. in diameter; styles filiform, 2-3 mm. long, stigma capitate; septum slightly nerved at the apex, areolae scarcely, if at all, tortuous; ovules 1-2 in each cell, funiculi attached to the septum for one-half their lengths or less; seeds nearly or quite filling the pods, not margined, radical somewhat turned to one side.

Distribution: Kentucky and northern Tennessee.

Specimens examined:

Kentucky: rocky soil, Valley View, May 16, 1903, *Biltmore Herb.* 4273a (U. S. Nat. Herb.); banks of Kentucky River, Frankfort, *Lesquereux* (Mo. Bot. Gard. Herb.).

Tennessee: limestone bluffs, Whites Bend, Davidson County, May 25, 1899, *Biltmore Herb.* 4273 (U. S. Nat. Herb.); Nashville, 1886, *Gattinger* (U. S. Nat. Herb.); Rising Sun Bluff, 14 miles below Nashville, April-May, 1886, *Gattinger* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

The original description of *Vesicaria globosa* Desv. is scarcely sufficient to confirm its specific identity with *V. Shortii* Gray, and this uncertainty is increased by reference to the 'Kew Index' and Kuntze's 'Revision' in which it is considered identical with *ludoviciana* (*argentea* MacM.). Fortunately, however, Dr. F. Gagnepain, of the Museum of Natural History in Paris, to whom fragments of *L. argentea* and *L. globosa* were sent, was able to confirm the present treatment by comparison with Desvaux's type. Dr. Gagnepain adds that the label on the type sheet reads *V. globulosa* instead of *V. globosa*.

*L. globosa* is apparently without close relatives in the genus and one is at a loss to know to which group of species to ally it. That its affinities are with this genus, however, there seems little doubt. The species may be readily recognized by the very numerous, small pods and the straight pedicels together with the conspicuously branching stems.

36. *L. mendocina* (Phil.) Kurtz, *Revista Mus. La Plata* (Sertum Cordobense) 5: 286. 1893; Macloskie, *Rep. Princeton Univ. Exp. to Patagonia* 8: 440. 1905.

*Vesicaria arctica* Hook. *Bot. Misc.* 3: 138. 1883; Barneoud



in Gay, Fl. Chilena 1: 161. 1845; Gilg & Muschler, Engl. Bot. Jahrb. 42: 466. 1909.

*V. mendocina* Phil. Linnaea 33: 12. 1864.

*V. andicola* Gill mss.; Ball, Jour. Linn. Soc. 21: 212. 1886.

*Alyssum Urbanianum* Muschler, Engl. Bot. Jahrb. 40: 274. 1908.

*A. bolivense* Muschler, Engl. Bot. Jahrb. 40: 275. 1908.

Perennial, densely stellate-pubescent throughout, stellae many-rayed, rays forked, coalescing at the base; stems decumbent or prostrate, 5-12 cm. long, unbranched; terminal bud remaining undeveloped; radical leaves 2-3 cm. long, narrowly oblanceolate, rarely over 5 mm. wide, entire or repand, very gradually narrowed to a slender petiole; cauline leaves narrowly oblanceolate, often rather numerous; petals yellow, obovate, about 1 cm. long; filaments linear; fruiting inflorescence rather short, lax; pedicels straight or often sigmoid, 1-2 cm. long; pods erect to horizontal, sessile, densely stellate-pubescent, short-ellipsoid, not compressed, 7-9 mm. long; styles about 4 mm. long, stigmas capitate; septum strongly nerved, areolae scarcely tortuous; ovules about 5 in each cell, funiculi long and slender, attached to the septum for about one-half their lengths.

Distribution: northern Argentine, adjacent Chile, and Bolivia.

Specimen examined:

Argentine: Cerro Negro, Catamarca, Sept. 2, 1916, *Jorgensen 1062* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Bolivia: Escayache bei Tarija, 3600 M., austro-Bolivia, Feb. 1, 1904, *K. Fiebig 3034* (Gray Herb.); Puna Patanca, 3700 M., Jan. 8, 1904, *K. Fiebig 2619* (Gray Herb.).

This species, although curiously isolated from its fellows, bears all the characteristics of a true member of this genus and seems more nearly related to certain species of the Rocky Mountains than to *L. montevidensis* of Uruguay. Kurtz observes that this plant grows in dry and especially in calcareous habitats. The flowers are said to be fragrant.

37. *L. valida* Greene, Pittonia 4: 68. 1899; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915.

Densely silvery stellate throughout; stems numerous, stout, decumbent, 12-15 cm. long, axillary to the outer leaves of a



rosulate tuft; radical leaves obovate or somewhat spatulate, entire or few-toothed, tapering to a petiole; cauline leaves oblanceolate, entire; inflorescence short and dense, hardly more than corymbose even in fruit; pods ovate, somewhat compressed, tipped with a style of half their own length; ovules about 6 in each cell.

Distribution: Gray, New Mexico.

The type of *L. valida* has not been seen nor have any specimens that could be referred to it. The ovate, compressed pod, as well as the short, dense inflorescence, seems to ally it to *L. intermedia*, with which, indeed, Wootton and Standley associate it. The plant is evidently a perennial although the original description leaves this in doubt. The root is described as a "single tap root." The type was collected at Gray, New Mexico, by Miss Josephine Skehan in 1898.

38. *L. intermedia* (Wats.) Heller, Plant World 1: 22, 1897; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 275. 1915; Rydb. Fl. Rocky Mountains, 332. 1917.

*Vesicaria alpina* Gray, Mem. Am. Acad. (Pl. Fendl.) 4: 9. 1849, not Nutt.

*Lesquerella alpina* (Gray) Wats. var. *intermedia* Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 117. 1895.

Cespitose perennial, densely stellate throughout, stellae small, rays distinct or irregularly coherent, forked at the base; caudex much branched; stems stout, erect or decumbent, 2-18 cm. long, unbranched; terminal bud developing a fertile stem or remaining undeveloped; radical leaves linear to linear-oblanceolate, thick, usually involute, entire, 1-7 cm. long; cauline leaves similar, rather remote; petals yellow, narrowly spatulate, about 1 cm. long; filaments linear; fruiting inflorescence crowded and subcorymbiform; pedicels straight or slightly curved, 1-1.5 cm. long, horizontal or ascending; pods sessile, ovate, stellate, 4-6 mm. long, acute but not compressed at the apex; styles 2.5-6 mm. long; septum entire, nerved, areolae slightly tortuous; ovules 3-8 in each cell, funiculi attached to septum for about one-half their lengths; seeds not winged.

Distribution: southeastern Colorado, northern New Mexico, southern Utah, Arizona.

## Specimens examined:

Colorado: 25 miles below Manitou, May 28, 1878, *Jones 114* (Rky. Mt. Herb., U. S. Nat. Herb., and Mo. Bot. Gard. Herb.); Canyon City, April, 1871, *Brandeggee 370* (Mo. Bot. Gard. Herb.); Canyon City, June 26, 1895, *Osterhout 786* (Rky. Mt. Herb. and Geo. Osterhout Herb.).

New Mexico: Santa Fe, 1847, *Fendler 23, 38* (Mo. Bot. Gard. Herb.); hills at Santa Fe, May 13, 1897, *Heller 3516* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Utah: Rabbit Valley, July 25, 1875, *Ward 418* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Jugtown, June 5, 1894, *Jones 5404* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); S. Utah, 1872, *Bishop* (U. S. Nat. Herb.); Marysvale, May 31, 1894, *Jones 5338e* (U. S. Nat. Herb.); Marysvale, June 1, 1894, *Jones 5355a* (U. S. Nat. Herb.); Marysvale, June 4, 1894, *Jones 5388b* (U. S. Nat. Herb.); road to Panguitch Lake, Sept. 5, 1894, *Jones 5996c* (U. S. Nat. Herb.); canyon above Tropic, May 28, 1894, *Jones 5312d, 5312e* (U. S. Nat. Herb.).

Arizona: Eldon Mountain, July 11, 1891, *MacDougal* (U. S. Nat. Herb.); Clear Creek Canyon, May 9, 1901, *Ward* (U. S. Nat. Herb.); Moran Point, Grand Canyon, June 9, 1901, *Ward* (U. S. Nat. Herb.); Grand Canyon, May 24, 1903, *Grant 938* (Rky. Mt. Herb.); Grand Canyon, June 29, 1913, *Hitchcock 24* (U. S. Nat. Herb.); rim of Grand Canyon, July 1, 1915, *Hitchcock* (U. S. Nat. Herb.); Grand Canyon, June, 1915, *Macbride & Payson 952* (Rky. Mt. Herb.); common, San Francisco Mountains, May 10, 1908, *Tidestrom 964* (U. S. Nat. Herb.); vicinity of Flagstaff, July 2, 1898, *MacDougal 203* (U. S. Nat. Herb. and Rky. Mt. Herb.); Slate Mountains, near Flagstaff, June, 1900, *Purpus 7096* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); near Flagstaff, May-Oct., 1902, *Purpus* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); near Flagstaff, June 23, 1901, *Leiberg 5553* (U. S. Nat. Herb.); vicinity of Flagstaff, May 26-27, 1908, *Rose 12111* (U. S. Nat. Herb.); Walnut Canyon, vicinity of Flagstaff, Aug. 7-11, 1915, *Hitchcock* (U. S. Nat. Herb.); common on rocky slopes, 10 miles east of Jerome Junction, May 1, 1908, *Tidestrom 909* (U. S. Nat. Herb.); Fort Apache, April 15, *Shuttleworth* (U. S. Nat. Herb.).

This plant is undoubtedly distinct from *L. alpina*. Its coarser

habit of growth, more numerous ovules, straight or slightly curved pedicels, and more completely inflated pods separate it from both *alpina* and *condensata*. It is not so easily distinguished from *L. arizonica*, however, and further knowledge of these two species may result in the reduction of *intermedia* to varietal rank under *arizonica*. Such a change would seem unfortunate because *intermedia* is a plant of wide distribution, while *arizonica* is quite limited in range. It is believed also that the latter species has been derived from *intermedia*—a relationship that would not be suggested by making the parent group a variety of the derived form.

39. *L. arizonica* Wats. Proc. Am. Acad. 23: 254. 1888; Wats. in Gray, Syn. Fl. N. Am. 1': 117. 1895; Armstrong, Field Book of Western Wild Flowers, 184. 1915.

Cespitose perennial, densely stellate throughout, stellae small, rays distinct or irregularly coherent, forked at the base; caudex much branched; stems usually erect, 1.5–8 cm. long, unbranched; terminal bud either developing a fertile stem or remaining undeveloped; radical leaves linear to oblanceolate, flat, entire, .5–2.5 cm. long, the lowermost usually noticeably shorter than the ones immediately above; cauline leaves linear to oblanceolate, 1–2.5 cm. long; petals yellow, narrowly spatulate, 6–7 mm. long; filaments linear; fruiting inflorescence crowded and sub-corymbiform; pedicels straight or slightly curved, 4–8 mm. long; pods sessile, erect or ascending, stellate, ovate, 4–6 mm. long, acute but scarcely compressed at the apex; styles 1–2 mm. long; septum entire, nerved, areolae slightly tortuous; ovules 4 in each cell, funiculi attached to septum for one-half their lengths or less; seeds not winged.

Distribution: northwestern Arizona.

Specimens examined:

Arizona: Mokiak Pass, 1877, *Palmer 43* (Mo. Bot. Gard. Herb.); Juniper Mountain, central Arizona, April, 1876, *Palmer 16* (Mo. Bot. Gard. Herb.); Ash Fork, May, 1883, *Rusby 514½* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Hackberry, May 26, 1884, *Jones 4371* (U. S. Nat. Herb.).

*L. arizonica* is very closely related to *L. intermedia* and is distinguished from it by the flat, shorter basal leaves and the

shorter style. It is apparently a more slender plant than the preceding species.

**39a. Var. nudicaulis Payson.<sup>1</sup>**

Perennial, silvery stellate throughout; caudex much branched, stems erect, 1-4 cm. long, naked; terminal bud apparently remaining undeveloped; radical leaves linear to linear-oblongate, mostly less than 1 cm. long; petals yellow; fruiting inflorescence subcorymbiform; pods sessile, stellate, about 4 mm. long, sometimes compressed at the apex; styles 1-2 mm. long; ovules 4-5 in each cell.

Distribution: northern Arizona.

Specimens examined:

Arizona: Buckskin Mountains, June 19, 1890, Jones (U. S. Nat. Herb. TYPE).

Fig. 25. *L. arizonica* var. *nudicaulis*. Habit sketch  $\times \frac{2}{5}$ . Trichomes  $\times 25$ .

A most interesting plant resembling superficially some of the perennial, scapose Drabas, but undoubtedly closely allied to *L. arizonica*. The leafless stems are, of course, its distinguishing feature.

**40. *L. alpina* (Nutt.) Wats.** Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 117. 1895; Rydb. Mem. N. Y. Bot. Gard. 1: 179. 1900; Rydb. Fl. Colo. 155. 1906; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909; Nelson, Spring Fl. Intermountain States, 65. 1912; Clements & Clements, Rocky Mountain Flowers, 25. 1914; Rydb. Fl. Rocky Mountains, 332. 1917.

*Vesicaria alpina* Nutt. in Torr. & Gray, Fl. N. Am. 1: 102. 1838; Walp. Rep. 1: 141. 1842; Dietr. Gen. Pl. 3: 638. 1843; Hooker's London Jour. Bot. 6: 70. 1847; Coulter, Manual Rocky Mountain Region, 25. 1885.

*Alyssum alpinum* Kuntze, Rev. Gen. Pl. 2: 931. 1891.

*Lesquerella parvula* Greene, Pittonia 4: 308. 1901; Rydb. Fl. Colo. 155. 1906; Rydb. Fl. Rocky Mountains, 332. 1917.

Cespitose perennial, stellate throughout, stellae small, rays

<sup>1</sup> *Lesquerella arizonica* Wats. var. *nudicaulis*, var. nov., perennis humilis; caulibus 1-4 cm. longis, nudatis; siliculis ovatis, stellato-pubescentibus, sessilibus.—Collected in the Buckskin Mountains, Arizona, June 19, 1890, M. E. Jones (U. S. Nat. Herb.).

numerous, irregularly coherent, branching; caudex much branched; stems erect, 2-14 cm. long, unbranched; terminal bud apparently never developing into a fertile stem; radical leaves linear to linear-oblongate, entire, 1-4 cm. long; cauline leaves similar; petals yellow, narrowly spatulate, 5-7 mm. long; filaments linear, slightly enlarged at the base; fruiting inflorescence usually elongated; pedicels sigmoid, 5-10 mm. long; pods erect or ascending, sessile, ovate, compressed at the apex, 4-5 mm. long, stellate; styles 2-4 mm. long; septum frequently perforate, nerved, areolae tortuous or nearly straight; ovules 2-4 in each cell, funiculi attached to septum for one-half their lengths or more; seeds not winged.

Distribution: in the mountains of Montana, Wyoming, and northern Colorado.

Specimens examined:

Montana: without definite locality, *Kelsey 92* (Mo. Bot. Gard. Herb.); mountains about Helena, June 6, 1887, *Anderson* (Mo. Bot. Gard. Herb.); dry uplands, Helena, May 19, 1905, *Blankinship 58* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Bridger Canyon, June 16, 1901, *Jones* (Rky. Mt. Herb.); Greycliff, Sweet Grass County, May 25-31, 1912, *Eggleston 7835* (U. S. Nat. Herb.); Wreck Creek, Greycliff, Sweet Grass County, May 29, 1912, *Eggleston 7853* (U. S. Nat. Herb.); Trail Creek, Park County, July 2, 1899, *Blankinship* (Mo. Bot. Gard. Herb.); north slope of Baldy Mountain, Absaroka Range, Park County, June 25, 1912, *Eggleston 8072* (U. S. Nat. Herb.); Spanish Basin, Gallatin County, June 23, 1897, *Rydberg & Bessey 4170* (Geo. Osterhout Herb., U. S. Nat. Herb., and Rky. Mt. Herb.); west Gallatin River, June 9, 1899, *Jones* (U. S. Nat. Herb.); Sedan, Gallatin County, May 14, 1901, *Jones* (U. S. Nat. Herb.).

Wyoming: Teton River, June 14, 1854, *Doty 166* (Mo. Bot. Gard. Herb.); forks of Green River, July 6, 1860, *Hayden* (Mo. Bot. Gard. Herb.); Hillon's, near Colorado line, July 5-10, 1896, *Osterhout 1104* (Geo. Osterhout Herb.).

Colorado: lat. 39-41°, July, 1864, *Parry* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); summit of Mt. Bross, Middle Park, July 29, 1876, *Patterson* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Sulphur Springs, Grand County, June 9, 1906, *Osterhout 3260* (Geo. Osterhout Herb.); Troublesome, Grand County,

July 13, 1905, *Osterhout 3029* (Geo. Osterhout Herb. and Rky. Mt. Herb.).

**40a. Var. *spathulata* (Rydb.) Payson, new comb.**

*Lesquerella spathulata* Rydb. Contr. U. S. Nat. Herb. 3: 486. 1896; Britton & Brown, Ill. Fl. 2: 136. 1897, ed. 2, 2: 154. 1913; Rydb. Mem. N. Y. Bot. Gard. 1: 179. 1900; Petersen, Fl. Nebraska, 62. 1912; Rydb. Fl. Rocky Mountains, 332. 1917; Bergman, Fl. North Dakota, 191. 1918.

*Vesicaria alpina* Macoun, Cat. Canadian Pl. 1: 54. 1883.

*Lesquerella alpina* Webber, Cat. Fl. Nebraska, 119. 1890.

*L. nodosa* Greene, Pittonia 4: 309. 1901.

Stems 3-12 cm. long; radical leaves oblanceolate to ovate, 1-4 cm. long; petals yellow; filaments linear; pedicels sigmoid, 5-10 mm. long; pods ovate, acute, usually compressed at the apex; ovules 2-4 in each cell.

Distribution: Northwest Territory, Saskatchewan, Alberta, Montana, western North and South Dakota, northwestern Nebraska, and northeastern Wyoming.

Specimens examined:

Northwest Territory: Cypress Hills, Aug. 4, 1880, *Macoun* (U. S. Nat. Herb.).

Saskatchewan: Wood Mountain Post, Assiniboia, June 17, 1895, *Macoun 10511* (Mo. Bot. Gard. Herb.); Milk River, Assiniboia, July 13, 1895, *Macoun 10313* (Mo. Bot. Gard. Herb.).

South Dakota: Short Pines, Harding County, June 9, 1911, *Visher 444* (Rky. Mt. Herb.); summit of Eagle Nest Butte, Washabaugh County, May 30, 1914, *Over 2008* (U. S. Nat. Herb.); Bad Lands, July, 1855, *Hayden* (Mo. Bot. Gard. Herb.).

Montana: hills, Midvale, June 17, 1903, *Umbach 85* (U. S. Nat. Herb.); Duck Lake, June 23, 1901, *Weller* (U. S. Nat. Herb.); Falls of the Missouri, May, 1879, *Havard* (U. S. Nat. Herb.); Great Falls, May 31-July 13, 1888, *Williams 6* (U. S. Nat. Herb.); high, sterile chalk hills on the Yellowstone, 1853-4, *Hayden* (Mo. Bot. Gard. Herb.); Deer Lodge Valley, July 19, 1905, *Jones* (U. S. Nat. Herb.); dry upland benches, Anaconda, May 19, 1906, *Blankinship 659* (U. S. Nat. Herb.); Custer, May 4, 1890, *Blankinship 30* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).



Wyoming: railroad right-of-way, Moorcroft, Aug. 2, 1901, *Nelson 8553* (Rky. Mt. Herb.); Gillette, June 9, 1897, *Rydberg & Bessey 4169* (U. S. Nat. Herb.); rolling plains between Sheridan and Buffalo, June 15–July 15, 1900, *Tweedy 3587* (Rky. Mt. Herb.).

Nebraska: Belmont, July 18, 1889, *Webber* (Mo. Bot. Gard. Herb.).

Numerous intermediates between typical *spatulata* and *alpina* make specific separation of the two seem impossible. The only consistent difference between them lies in the leaf outline, a character scarcely deserving more than varietal recognition were there fewer intermediates or a greater separation of ranges. *L. alpina* and its variety are separated from *L. arizonica* and *L. intermedia* by the distinctly sigmoid rather than nearly straight pedicels, by the fewer ovules, and by the more slender habit of growth. The elongated fruiting inflorescence is the most striking difference between these forms and *L. condensata* with its variety *laevis*.

41. *L. condensata* A. Nelson, Bull. Torr. Bot. Club 26: 238. 1899; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909; Nelson, Spring Fl. Intermountain States, 64. 1912; Rydb. Fl. Rocky Mountains, 332. 1917.

Densely caespitose perennial, pubescence rather loosely stellate, rays rather long, branched, distinct, not closely appressed to the plant surface; caudex much branched; stems erect, 1–3 cm. long, unbranched; terminal bud apparently always remaining undeveloped; radical leaves linear to linear-oblongate, entire, .5–2.5 cm.

long; cauline leaves few, similar; petals yellow, linear-spatulate, 5–7 mm. long; filaments linear, slightly broader at the base; fruiting inflorescence short, rarely exceeding the leaves; pedicels usually sigmoid, 3–7 mm. long; septum perforate or entire,



Fig. 26. *L. condensata*. Habit sketch  $\times \frac{3}{4}$ . Trichomes  $\times 25$ .

nerved, areolae usually more or less tortuous; ovules 2 in each cell, funiculi short, attached to the septum for about one-half their lengths; seeds not winged.

Distribution: southwestern Wyoming.

Specimens examined:

Wyoming: Tipton, June 17, 1898, *Nelson 4797* (Rky. Mt. Herb., TYPE); Green River, June 1, 1897, *Nelson 3071* (Rky. Mt. Herb.); Green River, June 25, 1895, *Shear 4369* (U. S. Nat. Herb.); stony hills, Kemmerer, June 1, 1907, *Nelson 9002* (Rky. Mt. Herb. and Mo. Bot. Gard. Herb.); Kemmerer, June 13, 1898, *Nelson 4675* (Mo. Bot. Gard. Herb.); head of Wind River Valley, May 31, 1860, *Hayden* (Mo. Bot. Gard. Herb.); stony slopes in the foothills, Laramie, May 30, 1900, *Nelson 6954* (Mo. Bot. Gard. Herb., Baker Herb. at Pomona College, Rky. Mt. Herb., and U. S. Nat. Herb., in part).

41a. Var. *laevis* Payson.<sup>1</sup>

Cespitose perennial, silvery stellate throughout, rays short, branched, irregularly coherent, appressed; caudex much branched; terminal bud apparently remaining undeveloped; pedicels 2-5 mm. long, straight or slightly curved; pods often compressed at the apex; ovules 2 in each cell; septum entire or perforate, areolae nearly straight.

Distribution: eastern Wyoming and southern Montana.

Specimens examined:

Montana: on gravelly, clay slopes, 10 miles east of Monida, Madison County, June 18, 1899, *A. Nelson & E. Nelson 5428* (U. S. Nat. Herb., Rky. Mt. Herb., and Mo. Bot. Gard. Herb.); Cottonwood Creek, July 30, 1896, *Flodman 497* (U. S. Nat. Herb.); ridge above Bannock City, July 19, 1880, *Watson 32* (U. S. Nat. Herb.).

Wyoming: Platte Canyon, June 27, 1901, *Goodding* (Rky. Mt. Herb.); Laramie Hills, May 21, 1892, *Buffum 66* (Rky. Mt. Herb.); Laramie Hills, May 4, 1894, *Nelson 62* (U. S. Nat. Herb. and Rky. Mt. Herb.); Laramie Hills, May 18, 1895, *Nelson 1218* (Mo. Bot. Gard. Herb., TYPE, Rky. Mt. Herb., and U. S. Nat. Herb.); Laramie Hills, May 30, 1898, *Nelson 4324* (U. S. Nat. Herb.); stony slopes in the foothills, Laramie,

<sup>1</sup> *Lesquerella condensata* (Nutt.) Wats. var. *laevis*, var. nov., folia siliculaeque adpresse pubescentia; caulibus quam foliis brevioribus.—Collected in the Laramie Hills, Albany County, Wyoming, May 18, 1895, *A. Nelson 1218* (Mo. Bot. Gard. Herb.).

May 30, 1900, *Nelson 6954* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., U. S. Nat. Herb. in part, and Geo. Osterhout Herb.); Freezeout Hills, July 11, 1898, *E. Nelson 4854* (Rky. Mt. Herb.).

With the exception of one collection (*Nelson 6954*), typical *condensata* is recorded only from western Wyoming. Since no other collections of *condensata* have been made at Laramie and since it is quite possible that the collections from the western and eastern parts of the state were inadvertently mixed in the distribution, it is assumed that *condensata* is confined to western Wyoming, and that the variety *laevis* occurs in eastern Wyoming and southern Montana, but not within the range of typical *condensata*. Due to an unfortunate error in distribution the type collection of the variety *laevis* was labelled *Draba glacialis* and consequently may be located under that name in herbaria.

*L. condensata* and its variety differ from *alpina* chiefly in the much-reduced stems and in the constant reduction of their ovules to two in each cell. The variety *laevis* is distinguished from the typical form by the character of the pubescence, and although this at first may seem of slight consequence, it appears to be invariable and is so characteristic that the two may be easily separated without the aid of a lens. These forms are two of a number of interesting pulvinate plants, not uncommon on the high plains of southern Wyoming, that give to the vegetation an aspect quite alpine, an appearance that is always a little surprising at so low an altitude.

#### 42. *L. Garrettii* Payson.<sup>1</sup>

Perennial, stellate-pubescent throughout, stellae small, rays numerous, forked near the base, distinct or irregularly coherent; stems very slender, erect or decumbent, unbranched, 3-5 cm. long; terminal bud apparently developing a fertile stem; radical leaves 1-3 cm. long, blade entire, obtuse, spatulate or narrowly elliptical, gradually narrowed to the very slender and much longer petiole; flowers 3-7; petals very narrowly spatulate,

<sup>1</sup> *Lesquerella Garrettii* sp. nov., perennis humilis pube lepidostellata undique argentea; caulibus tenuissimis erectis vel procumbentibus simplicibus 3-5 cm. longis; foliis radicalibus integris spatulatis vel sublineari-oblongis 1-3 cm. longis; pedicellis erectis vel leviter sinuosis; siliculis subglobosis, circiter 4 mm. diametro stellato-pubescentibus, distincte stipitatis; stylis 4-5 mm. longis; loculis 4-ovulatis; funiculis septo adnatis; seminibus immarginatis.—Type collected in Big Cottonwood Canyon, Salt Lake County, Utah, June 28, 1905, by A. O. Garrett 1344 (Mo. Bot. Gard. Herb.).

yellow, 6-7 mm. long; filaments linear, slightly larger at the base; fruiting inflorescence short; pedicels usually with a tendency to become sigmoid, 3-6 mm. long; pods erect or ascending, densely stellate-pubescent, rays of stellae not appressed, subsessile, or distinctly stipitate, subglobose, 3-4 mm. long; stipe black, less than 1 mm. long, styles slender, 4-5 mm. long; septum nerved, perforate, areolae not tortuous; ovules 4 in each cell, funiculi attached to the septum for one-half their lengths or less; seeds not margined.

Distribution: Salt Lake County, Utah.

Specimens examined:

Utah: in clefts in rock on mountain side, Big Cottonwood Canyon, Salt Lake County, June 28, 1905, *Garrett 1344* (Mo. Bot. Gard. Herb., TYPE, and Rky. Mt. Herb.).

This plant is apparently most nearly related to *L. alpina* (Nutt.) Wats., but is at once separated from that species by the presence of a definite stipe. The pods are subglobose and inflated in the new species, while in *alpina* they are conspicuously elongated and compressed at the apex. In general appearance also it is unlike *alpina* because of its much more slender, lax stems. The name is given in honor of the collector, Prof. A. O. Garrett, of Salt Lake City, Utah, who writes me that he has collected this plant at an altitude of 9700 feet in rich, wet, loamy soil in a granitic locality from which the snow had but recently melted.

43. *L. cinerea* Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 118. 1895.

*L. ? cinerea* Wats. Proc. Am. Acad. 23: 255. 1888.

Perennial, densely stellate-pubescent throughout, stellae conspicuously granular, rays many, distinct, forked near the base; stems prostrate or decumbent, unbranched, 6-12 cm. long; terminal bud remaining undeveloped; radical leaves 1-2.5 cm. long, spatulate or oblanceolate, entire or obscurely repand, obtuse or acute; cauline leaves numerous, oblanceolate, 5-15 mm. long; petals yellow, frequently turning reddish on fading, narrowly spatulate, 8-10 mm. long; filaments linear, slightly enlarged at the base; fruiting inflorescence elongated, occasionally somewhat leafy; pedicels straight or somewhat sigmoid, 5-9 mm. long; pods erect or ascending, sessile, densely stellate-

pubescent, ellipsoid, inflated, slightly obcompressed, particularly when young, about 5 mm. long; styles shorter than the pods; septum nerved, areolae not tortuous; ovules 7-12 in each cell, funiculi attached to septum for less than one-half their lengths; seeds not winged.

Distribution: Arizona.

Specimens examined:

Arizona: without definite locality, 1869, *Palmer* (U. S. Nat. Herb.); Belmont, June 29, 1892, *Toumey 65* (U. S. Nat. Herb.); dry soil near Kendrick Mountains, June 28, 1901, *Leiberg 5599* (U. S. Nat. Herb.); common on slopes near Elgin, April 11, 1908, *Tidestrom 823* (U. S. Nat. Herb., in part).

This interesting plant, though possessing few characteristic peculiarities, is evidently quite distinct from other known species of the genus. It is to be associated with *Kingii* and its relatives, and like them develops a dense rosette. It may be distinguished from any of them by the spatulate basal leaves in which the blade tapers gradually to the broad petiole. No specimens have been seen in completely mature condition. It is apparently a very rare plant.

44. *L. Kingii* Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 117. 1895.

*Vesicaria Kingii* Wats. Proc. Am. Acad. 20: 353. 1885.

Perennial, silvery stellate throughout, stellae small, rays few to numerous, distinct or irregularly coherent, forked at the base; stems rather lax, 1-2 dm. long, usually unbranched; terminal bud remaining undeveloped; radical leaves 1.5-7 cm. long, blade ovate to suborbicular, entire, obtuse, narrowed abruptly to the slender petiole which usually exceeds the blade in length; cauline leaves oblanceolate, .5-2 cm. long, entire, obtuse or acute; petals narrowly spatulate, yellow or fading purplish, 7-8 mm. long; filaments linear; fruiting inflorescence elongated; pedicels horizontal or recurved, decidedly sigmoid, 8-12 mm. long;



Fig. 27. *L. cinerea*. Habit sketch  $\times \frac{1}{4}$ . Trichomes  $\times 25$ .

Pods erect or horizontal, subsessile or shortly stipitate, subglobose, not compressed, 3-5 mm. in diameter, rather sparingly stellate-pubescent; styles slender, equaling or slightly exceeding the pods; septum nerved, areolae not tortuous; ovules 2-4, funiculi short, attached to the septum for less than one-half their lengths; seeds not winged.



Fig. 28. *L. Kingii*. Habit sketch  $\times \frac{1}{2}$ . Trichomes  $\times 25$ .

Distribution: Nevada and southeastern California.

Specimens examined:

Nevada: west Humboldt Mountains, June, 1868, *Watson 82* (Gray Herb., TYPE, photograph Mo. Bot. Gard. Herb., and tracing Rky. Mt. Herb.); Big Creek and Kingston Canyon, Toiyabe Forest, July 28, 1913, *Hitchcock 807* (U. S. Nat. Herb.); dry ground, Bunker Hill, Toiyabe Forest, July 29, 1913, *Hitchcock 848, 858* (U. S. Nat. Herb.); rocky slopes, Mt. Sabb, Palmetto Range, May-Oct., 1898, *Purpus 5863* (U. S. Nat. Herb. and Baker Herb. at Pomona College).

California: Telescope Peak, Panamint Mountains, June 23, 1891, *Coville & Funston 2025* (Gray Herb. and U. S. Nat. Herb.).

*L. Kingii* was the first of a number of forms to be described from the region of the Great Basin that are here being treated as species. These are *L. Wardii*, *L. prostrata*, *L. utahensis*, and *L. latifolia*. The differences between them are slight and within their specific limits they show considerable variation. There is evidently here a remarkable plexus of evolution due perhaps to some germinal plasticity or perhaps to the topographical character of the country that isolates races on every detached mountain range. However the presence of such an assemblage of minute forms may be explained, the result remains difficult of treatment by the taxonomist. Perhaps they were best regarded as varieties under one great species, but in the present case this might easily result in a polyphyletic group and so emphasize an unnatural relationship.



*L. Kingii*, because of its subglobose pods, will be confused with *utahensis* rather than the other members of this group. It is a less distinctly cespitose plant than *utahensis*, has as a rule fewer stems, and is less floriferous, the leaves are apparently always entire, and the petals exceed the sepals by not more than one-third their lengths. The pedicels are more distinctly sigmoid, the pods more densely pubescent than in *utahensis* and are never compressed at right angles to the septum. *Kingii* has not yet been collected in Utah, while *utahensis* has never been found outside that state. The habit sketch reproduced here was drawn from the type of *Kingii*, while the fragment of fruiting inflorescence is taken from Hitchcock's No. 807.

45. *L. latifolia* A. Nelson, Bot. Gaz. 42: 49. 1906.

Perennial, appressed stellate-pubescent throughout, rays of the stellae numerous, distinct or irregularly coherent, usually forked near the base; stems erect or decumbent, 1-2 dm. long, unbranched, rather stout; terminal bud remaining undeveloped; radical leaves 2-8 cm. long, obtuse, blade suborbicular, ovate or oblong, entire or irregularly margined, narrowed abruptly to a slender petiole 1.5-5 cm. long; cauline leaves broadly oblanceolate to spatulate, obtuse, 1-2 cm. long; flowers numerous, conspicuous; petals yellow, narrowly spatulate, 7-9 mm. long; filaments linear; fruiting inflorescence elongated; pedicels conspicuously sigmoid, 5-7 mm. long, horizontal or even recurved; pods erect, stellate-pubescent, oblong, 5-7 mm. long, somewhat flattened parallel to the partition, distinctly stipitate, stipe black, about 5 mm. long; styles 2-3 mm. long; septum nerved, entire, areolae not tortuous; ovules 6 in each cell, funiculi long and slender, attached to the septum for less than one-half their lengths; seeds not margined.

Distribution: southern Nevada.



Fig. 29. *L. latifolia*. Habit sketch  $\times \frac{1}{8}$ . Trichomes  $\times 25$ .

## Specimens examined:

Nevada: mountain tops, Karshaw, Meadow Valley Wash, April 26, 1902, *Goodding 625* (Rky. Mt. Herb., TYPE, and Mo. Bot. Gard. Herb.).

This is certainly a most unusual plant and further collections will be awaited with interest. In general appearance it is not unlike *L. Kingii* except for the more floriferous racemes and more numerous stems. It is definitely separated from that species, however, by the lengthened pods and the more distinct stipe. The pods in the type specimen are scarcely mature but seem evidently flattened parallel to the septum. The type collection was distributed under the name of *L. montana*.

46. *L. Wardii* Wats. in Gray, Syn. Fl. N. Am. 1: 118. 1895; Rydb. Fl. Rocky Mountains, 332. 1917.

*L. ? Wardii* Wats. Proc. Am. Acad. 23: 255. 1888.

Perennial, densely stellate-pubescent throughout, stellae small, many-rayed, rays forked near the base, distinct or irregularly co-

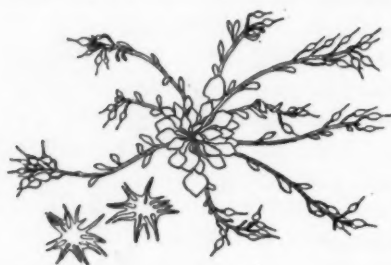


Fig. 30. *L. Wardii*. Habit sketch  $\times \frac{1}{2}$ . Trichomes  $\times 25$ .

herent; stems mostly prostrate, 4-10 cm. long, stiff, unbranched; terminal bud remaining undeveloped; radical leaves 1-4 cm. long, blade ovate, suborbicular or rarely subhastate, usually quite entire, narrowed abruptly to the slender petiole which equals or exceeds it in length; cauline leaves broadly oblanceolate to

nearly linear, 8-18 mm. long; petals yellow, very narrowly spatulate, about 7 mm. long; filaments linear, slightly enlarged at the point of attachment; fruiting inflorescence rather short, crowded; pedicels straight and erect or ascending or, particularly the lower ones, horizontal and more or less sigmoid, 5-7 mm. long; pods erect or ascending, sessile or subsessile, ovoid or ellipsoid, usually acute at the apex, sometimes slightly flattened at right angles to the septum, rather densely stellate-pubescent, 4-10 mm. long; styles 3-5 mm. long, usually

shorter than the mature pod; septum nerved, entire or perforate, areolae polygonal or somewhat tortuous; ovules 2-8 in each cell, funiculi attached to the septum for about one-half their lengths; seeds not margined, radical turned slightly to one side.

Distribution: in the mountains of south central Utah and western Nevada.

Specimens examined:

Utah: Mt. Ellen, Henry Mountains, July 24, 1894, *Jones 5667c* (U. S. Nat. Herb.); Mt. Ellen Peak, Henry Mountains, July 25, 1894, *Jones 5684e* (U. S. Nat. Herb.); Bromide Pass, Mt. Ellen, Henry Mountains, July 27, 1894, *Jones 5695b* (U. S. Nat. Herb.); Aquarius Plateau, Aug. 16, 1875, *Ward 589* (Mo. Bot. Gard. Herb.).

Nevada: spring in desert near Goshoot Mountains, May 8, 1859, *H. Engelmann 90* (Mo. Bot. Gard. Herb.); ridge south side of Lee Canyon, Charleston Mountains, in limestone, Clark County, July 26, 1913, *Heller 11004* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Rush Valley, May 2, 1859, *H. Engelmann 94* (Mo. Bot. Gard. Herb.).

*L. Wardii* forms a dense and strikingly symmetrical rosette and is evidently a plant of higher, more exposed localities than is *utahensis*. It also differs from that species, besides in the characters elsewhere mentioned, in having the shorter, solitary stamens incompletely surrounded at the base by the nectar glands. In fruit characters it is quite similar to *L. prostrata*, but unlike that species, has entire, obtuse leaves.

47. *L. utahensis* Rydb. Bull. Torr. Bot. Club 30: 252. 1903; Rydb. Fl. Rocky Mountains, 333. 1917.

Perennial, stellate-pubescent throughout, stellae small, rays numerous, forked at or near the base, distinct or irregularly coherent; stems decumbent or procumbent, 5-20 cm. long, unbranched; terminal bud remaining undeveloped; radical leaves 2-5 cm. long, blade ovate to oblong, entire, subhastate or rarely fiddle-shaped, usually obtuse, narrowed abruptly to the slender petiole which usually exceeds the blade in length; cauline leaves broadly oblanceolate to spatulate, entire, 5-15 mm. long; flowers numerous, showy; petals yellow or sometimes tinged with red, narrowly spatulate, 7-9 mm. long; filaments

slightly broadened at the base; fruiting inflorescence elongated;



Fig. 31. *L. utahensis*. Habit sketch  $\times \frac{1}{3}$ .  
Trichomes  $\times 25$ .

pedicels ascending, horizontal or even recurved, usually with a tendency to become sigmoid, 4–10 mm. long; pods erect to horizontal, subsessile, 3–5 mm. in diameter, sparsely stellate-pubescent, sometimes nearly glabrous, more or less obcompressed, apex usually truncate and rarely slightly emarginate, in some speci-

mens referred here pods subglobose; styles very slender, 4–5 mm. long; septum entire or perforate, nerved, areolae not tortuous; ovules 2–6 in each cell, funiculi attached to septum for less than one-half their lengths; seeds not margined.

Distribution: in the mountains of Utah.

Specimens examined:

Utah: Logan Peak, Cache County, July 4, 1910, *Smith 2248*, *2244* (Rky. Mt. Herb.); Brigham Peak, Aug. 29, 1894, *Jones 5958u* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); rocky ridges, Dyer Mine, Uintah Mountains, July 5, 1902, *Goodding 1258* (Rky. Mt. Herb., U. S. Nat. Herb., and Mo. Bot. Gard. Herb.); Big Cottonwood Canyon, between Silver Lake and the summit of Mt. Majestic, June 28, 1905, *Rydborg & Carlton 6411* (Rky. Mt. Herb. and U. S. Nat. Herb.); in clefts in exposed rocks, Big Cottonwood Canyon, Salt Lake County, July 1, 1905, *Garrett 1370* (U. S. Nat. Herb.); American Fork Canyon, July 31, 1880, *Jones 1354* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); common on rocky ridges along Ephraim sheep trail, July 1, 1908, *Tidestrom 1322* (U. S. Nat. Herb.); plateau east of Ephraim Canyon, Aug. 14, 1907, *Tidestrom 203* (U. S. Nat. Herb.); head of Salina Canyon, June 15, 1894, *Jones 5441* (Mo. Bot. Gard. Herb. and Rky. Mt. Herb.); Marysvale, June 2, 1894, *Jones 5375e* (U. S. Nat. Herb.); Marysvale in Bullion Canyon, June 5, 1894, *Jones 5397b* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., and U. S. Nat. Herb.); mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydborg & Carl-*

ton 7160 (Rky. Mt. Herb. and U. S. Nat. Herb.); Panguitch Lake, Sept. 6, 1894, *Jones 6002e* (U. S. Nat. Herb.); canyon above Tropic, May 28, 1894, *Jones 5312d* (U. S. Nat. Herb.).

*L. utahensis* is perhaps the most interesting of all the species of *Lesquerella* because of the great similarity, in some of its forms particularly, to members of the genus *Physaria*. So striking, indeed, is this similarity that one is a little perplexed at times to know to which genus a given plant should be referred. And yet *utahensis* as a species is not entirely satisfactory, so close is it to other forms that give no suggestion of *Physaria*. The bridge connecting the two genera is nearly complete.

*L. utahensis*, as here limited, is rather polymorphic and when more adequate collections are at hand it may be capable of resolution into several geographic varieties. This species seems most closely related to *Wardii* but that species has, when mature, large, irregularly ellipsoid pods. Both are conspicuous rosette formers. *L. Kingii* is perhaps more difficult to separate from *utahensis* than is *Wardii*. It has a more southern and western range, the stems are longer and more nearly erect, and the pods more densely pubescent. *L. prostrata* differs from the present species in the somewhat elongated pods and the acute, frequently subhastate leaves.

48. *L. prostrata* A. Nelson, Bull. Torr. Bot. Club 26: 124. 1899; Nelson in Coulter & Nelson, Manual Cent. Rocky Mountains, 219. 1909; Rydb. Fl. Rocky Mountains, 332. 1917.

Perennial, silvery stellate-pubescent throughout, stellae many-rayed, rays forked near the base, distinct; stems prostrate or ascending, unbranched, 6–15 cm.

long; terminal bud remaining undeveloped; radical leaves ovate or subhastate, obtuse or acute, usually distinctly angular, 1–3.5 cm. long, blade abruptly narrowed to the slender petiole which usually exceeds it in length;



Fig. 32. *L. prostrata*. Habit sketch  $\times \frac{1}{8}$ . Trichomes  $\times 25$ .

cauline leaves oblanceolate to linear, 8-15 mm. long; petals yellow, narrowly spatulate, 6-7 mm. long; filaments slightly and gradually broadened toward the base; fruiting inflorescence elongated; pedicels erect or ascending, straight or slightly sigmoid, 5-8 mm. long; pods erect or ascending, sessile, rather sparsely stellate-pubescent, ovoid, not compressed, usually acute at the apex, 5-6 mm. long; styles rather stout, 3-4 mm. long; septum nerved, perforate, areolae not tortuous; ovules 2-3 in each cell, funiculi attached to the septum for less than one-half their lengths; seeds not winged.

Distribution: southwestern Wyoming and southern Idaho.

Specimens examined:

Wyoming: Piedmont, June 7, 1898, *Nelson 4564* (Rky. Mt. Herb., TYPE, and Mo. Bot. Gard. Herb.).

Idaho: open stony slopes near base of peak, south end of Soldier Mountains, June 26, 1916, *Macbride & Payson 2897* (Mo. Bot. Gard. Herb., Rky. Mt. Herb., and U. S. Nat. Herb.).

*L. prostrata* and *L. utahensis* are certainly very closely related, and it is quite possible that collections showing characters intermediate between the two may be made in northern Utah. In the Idaho specimen the septum is so largely perforate that only a narrow margin remains around the replum.

49. *L. diversifolia* Greene, *Pittonia* 4: 309. 1901.

Perennial, densely stellate-pubescent throughout with many-



Fig. 33. *L. diversifolia*. Habit sketch  $\times \frac{1}{4}$ .  
Trichomes  $\times 25$ .

rayed stellae, rays distinct, forked near the base; caudex enlarged, clothed with the persistent leaf-bases of previous years, frequently branched; stems usually prostrate, 4-15 cm. long, unbranched; terminal bud remaining undeveloped; radical leaves 2-6 cm. long, blade entire, ovate to nearly orbicular, usually

rather abruptly narrowed to the petiole, obtuse or acutish; cauline leaves narrowly oblanceolate, rather few, 5-25 mm. long; petals



yellow, narrowly spatulate, 7 mm. long; filaments linear; fruiting inflorescence elongated; pedicels conspicuously sigmoid, 5–10 mm. long; pods horizontal to erect, sessile, densely stellate-pubescent, circular, oblong or obovate, flattened somewhat parallel to the septum, compressed at the apex and along the margins, 4–6 mm. long; septum nerved, entire or perforate, areolae more or less tortuous; ovules 2 in each cell, funiculi attached to the septum for less than one-half their lengths; seeds not margined or winged, radical turned slightly to one side.

Distribution: in the mountains of central Idaho and eastern Oregon.

Specimens examined:

Idaho: Lost River Mountains, Aug. 14, 1895, *Henderson 3885* (U. S. Nat. Herb.); divide of Warm Spring and Little Smoky Creeks, Sawtooth Mountains, Aug. 7, 1909, *Woods & Tidestrom 2728* (U. S. Nat. Herb.); Sawtooth National Forest, 1910, *Woods 56a* (Rky. Mt. Herb.); loose, sliding slopes, Smoky Mountains, Aug. 13, 1916, *Macbride & Payson 3770* (Rky. Mt. Herb., U. S. Nat. Herb., and Mo. Bot. Gard. Herb.).

Oregon: dry mountain sides, Wallowa Mountains, Aug. 5, 1899, *Cusick 2304* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); granitic soil, extreme source of Imnaha River, Wallowa Mountains, Aug., 1906, *Cusick 3135* (U. S. Nat. Herb., Rky. Mt. Herb., and Mo. Bot. Gard. Herb.); alpine sliding sands, Wallowa Mountains, *Cusick 3700* (U. S. Nat. Herb.); Steins Mountains, near Wild Horse Creek, July 15, 1898, *Cusick 2036* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

This essentially alpine plant is characterized by the enlarged caudices, dense rosettes, and short stems. In fruit characters it is very similar to *L. occidentalis* and might with propriety be considered varietally under that species. The two plants are rather easily separated, and since their ranges also seem not to merge it was thought advisable to retain the original treatment.

50. *L. occidentalis* Wats. Proc. Am. Acad. 23: 251. 1888; Wats. in Gray, Syn. Fl. N. Am. 1<sup>1</sup>: 117. 1895; Howell, Fl. Northwest Am. 51. 1897; Piper, Contr. U. S. Nat. Herb. 11: 298. 1906; Piper & Beattie, Fl. Northwest Coast, 176. 1915.

*Vesicaria montana* Wats. Bot. Calif. 1: 43. 1876, and suppl. 2: 432. 1880.

*V. occidentalis* Wats. Proc. Am. Acad. 20: 353. 1885.

*Physaria montana* Greene, Fl. Franciscana, 249. 1891.

Perennial, silvery stellate-pubescent throughout with many-rayed stellae, rays forked near the base; caudex more or less enlarged, woody; stems decumbent to erect, 1-2 dm. long, unbranched; terminal bud remaining undeveloped; radical leaves 2-7 cm. long, blade ovate or narrower, tapering gradually to the petiole, entire, frequently repand or even sublyrate; cauline leaves oblanceolate, entire, 1-1.5 cm. long; petals yellow, narrowly spatulate, 9-10 mm. long; filaments linear; fruiting inflorescence elongated; pedicels conspicuously sigmoid, 8-12 mm. long; pods usually erect, sessile, densely stellate-pubescent, oblong to obovate, flattened somewhat parallel to the partition, compressed at the apex and along the margins, 4-6 mm. long; styles 4-5 mm. long; septum entire or perforate, nerved, areolae somewhat tortuous; ovules usually 2 in each cell, funiculi attached for about one-half their lengths; seeds not margined, radical somewhat turned to one side.

Distribution: northeastern California and adjacent Oregon.

Specimens examined:

Oregon: Steins and southern Blue Mountains, July 21, 1898, *Cusick 2054* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Mitchell, May 14, 1885, *Howell* (U. S. Nat. Herb.).

California: Humbug Hills near Yreka, June 30, 1876, *Greene 902* (Gray Herb., TYPE, photograph Mo. Bot. Gard. Herb.); Marble Mountain, Siskiyou County, June, 1901, *Chandler 1653* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); Greenhorn Mountain, Siskiyou County, May 15, 1910, *Butler 1342* (U. S. Nat. Herb. and Rky. Mt. Herb.); loose rocky ground, mountain on Truckee River, Placer County, June, 1887, *Sonne 23* (U. S. Nat. Herb.).

The typical *L. occidentalis*, as distinguished from the segregates *L. diversifolia* and *L. Cusickii*, possesses stout stems that carry even the lowermost pods of the fruiting inflorescence well beyond the longest radical leaves. The caudex, although definitely perennial, is not so densely clothed with leaf bases as is *diversifolia*, due perhaps to a less distinctly alpine habitat.

51. *L. Cusickii* Jones, Contr. Western Botany 12: 2. 1908.

Annual or short-lived perennial, densely stellate-pubescent throughout, stellae many-rayed, rays forking near the base, distinct or irregularly coherent; stems numerous, unbranched, 4-20 cm. long; terminal bud remaining undeveloped; radical leaves 2-6 cm. long, blade suborbicular, ovate or broadly oblanceolate, entire or repand, frequently abruptly narrowed to the slender petiole; cauline leaves 1-2.5 cm. long, entire or repand, oblanceolate; petals yellow, narrowly spatulate, 7-8 mm. long; filaments linear; fruiting inflorescence elongated; pedicels horizontal or even recurved, conspicuously sigmoid, 6-14 mm. long; pods sessile, erect to horizontal, densely stellate-pubescent, suborbicular to obovate, somewhat flattened parallel to the septum, compressed at the apex and on the margins, 4-6 mm. long; styles 2-4 mm. long; septum entire, nerved, areolae somewhat tortuous; ovules 2 in each cell, funiculi attached for about one-half their lengths; seeds not margined.

Distribution: Oregon.

Specimens examined:

Oregon: Fossil, Gilliam County, May 30, 1894, *Leiberg* 130 (U. S. Nat. Herb., Rky. Mt. Herb., and Mo. Bot. Gard. Herb.); white clay hills of Willow Creek, Malheur County, May 3, 1900, *Cusick* 2367 (U. S. Nat. Herb., Rky. Mt. Herb., and Mo. Bot. Gard. Herb.); banks of Otis Creek, Malheur County, June 20, 1896, *Leiberg* 2337 (U. S. Nat. Herb.).

*L. Cusickii*, although agreeing with *occidentalis* in the characters of the pods, is definitely separated from it and *diversifolia* by the short-lived root. It apparently occurs only on white clay soils at a low altitude and to most of the herbarium specimens the white soil still adheres.

52. *L. Douglasii* Wats. Proc. Am. Acad. 23: 255. 1888; Howell, Fl. Northwest Am. 52. 1897; Piper, Contr. U. S. Nat. Herb. 11: 298. 1906; Henry, Fl. Southern British Columbia, 145. 1915.

*Vesicaria ludoviciana* Hook. Fl. Bor. Am. 1: 48. 1840; Torr. Wilkes' U. S. Expl. Exp. 17: 232. 1874.

Perennial, silvery stellate throughout, stellae many-rayed, rays forked at the base, distinct or irregularly coherent; caudex

usually unbranched; stems numerous, erect or decumbent, un-



Fig. 34. *L. Douglasii*. Habit sketch  $\times \frac{1}{8}$ . Trichomes  $\times 25$ .

branched, 1-4.5 dm. long; terminal bud remaining undeveloped; radical leaves 3-10 cm. long, blade obovate to very narrowly oblanceolate, entire, repand or with a few conspicuous teeth, acute or obtuse, tapering gradually to a long slender petiole; cauline leaves narrowly oblanceolate to linear, 1-5 cm. long, entire or very shallowly toothed; petals narrowly spatulate, 6-9 mm. long; filaments linear; fruiting inflorescence elongated; pedicels 6-15 mm. long, usually horizontal, straight or sigmoid, the lowermost frequently recurved; pods erect, horizontal or rarely pendent, sessile, rather sparsely stellate-pubescent, globose or slightly elongated, not compressed, 3-4 mm. in diameter; styles slender, equalling or longer than the pods; septum nerved, areolae somewhat tortuous; ovules 2-4 in each cell, funiculi attached to the septum for about one-half their lengths; seeds not margined.

Distribution: southern British Columbia, central Washington, and northern Oregon.

Specimens examined:

British Columbia: Lake Osoyoos, June 7, 1905, *Macoun 70853* (Mo. Bot. Gard. Herb.).

Washington: Conconully, eastern Washington, June, 1902, *Griffiths & Cotton 312* (U. S. Nat. Herb.); without definite locality, 1889, *Vasey 186* (U. S. Nat. Herb.); upper Columbia, *Wilkes 857* (U. S. Nat. Herb.); gravelly hillside north of Wenatchee River, May 14, 1899, *Whited 1065* (U. S. Nat. Herb.); rocky bar of Columbia at Wenatchee, June 2, 1899, *Whited 1119* (U. S. Nat. Herb.); near Wenatchee, May 24, 1900, *Whited 1247* (U. S. Nat. Herb.); rocky bar of Columbia River, Wenatchee, May 14, 1905, *Whited 2606* (U. S. Nat. Herb.); Rock Island, Kittitas County, July 10, 1893, *Sandberg & Leiberg 426* (U. S.

Nat. Herb.); banks of the Columbia River near Columbus, April 14, June, 1886, *Suksdorf* 842 (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.).

Oregon: Columbia River near Umatilla, May 1, 1882, *Howell* (U. S. Nat. Herb. and Mo. Bot. Gard. Herb.); along Columbia River at Heppner Junction, April 16, 1903, *Lunell* (U. S. Nat. Herb.); Biggs, Sherman County, May 31, 1910, *Heller* 10114 (U. S. Nat. Herb.).

*L. Douglasii* is a definitely limited species marking the farthest migration of the genus to the northwest. Its closest relative apparently is *L. occidentalis*. From this species and its relatives it is at once separated by the inflated pods that are not at all compressed at the margins and by the taller, more nearly erect stems. The geographical distribution, so far as available specimens show, is peculiarly limited to the Valley of the Columbia River.

#### SPECIES EXCLUDED

*Lesquerella velebitica* Degen, Magyar Bot. Lap. 8: 3. 1909 = *Degenia velebitica* (Degen) Hayek, Oesterr. Bot. Zeitschr. 60: 93. 1910.

This interesting plant from the Balkans is of strikingly similar aspect to certain species of *Lesquerella* but is certainly not to be regarded as having been derived from the same group of *Cruciferae* as they. Its elevation to generic rank seems a satisfactory disposition of it.

*Lesquerella thlaspiiformis* (Phil.) Gilg & Muschler in Engl. Bot. Jahrb. 42: 466. 1909 = *Eudema thlaspiiforme* Phil. Anal. Univ. Chile, 675. 1872.

This plant is unknown to the author but from the description seems not to be referable to *Lesquerella*. It is a native of the province of Santiago, Chile.

*Lesquerella flexuosa* Brandegees, Zoe 5: 233. 1906.

The relationship of this plant will be treated in a subsequent paper. Its affinity is certainly not with *Lesquerella*.

#### LIST OF EXSICCATAE

In the following index to the specimens cited in this monograph the collector's number, if one occurs, is printed in italics

and is followed immediately by a number in parentheses. The latter number indicates the serial number of the species involved as adopted in the present study. The name of this species follows the parentheses.

Anderson, F. W.

(40) *L. alpina*; (21) *L. argentea*.

Baker, C. F.

2 (15) *L. Fendleri*; 354 (32) *L. rectipes*; (33) *L. montana*.

Baker, C. F., Earle, F. S. & Tracy, S. M.

86 (32) *L. rectipes*; 901 (33) *L. montana*.

Baker, C. F. & Holzinger, J. M.

92 (33) *L. montana*.

Baker, H. P.

(21) *L. argentea*.

Ball, J.

1697 (5) *L. auriculata*; (21) *L. argentea*; (33) *L. montana*.

Bandelier, A. F.

(15) *L. Fendleri*.

Barnes, S. O.

(1) *L. Lescurii*.

Bates, J. M.

(21) *L. argentea*.

Beals, I. M.

(27) *L. Gordonii*.

Beard, A.

(27) *L. Gordonii*.

Bergman, H. F.

1876 (21) *L. argentea*.

Berlandier, J. L.

819, 884, 2239, 2314 (13) *L. Berlandieri*; 2538 (6) *L. grandiflora*; 3102, 3017

(2a) *L. lasiocarpa* var. *Berlandieri*.

Bethel, E.

(9) *L. ovalifolia*; (30) *L. pruinosa*.

Bigelow, J. M.

(15) *L. Fendleri*.

Biltmore Herbarium.

1292, 2695a (33) *L. montana*; 2695a (26) *L. gracilis*; 4273, 4273a (35) *L. globosa*; 6966a (18) *L. recurvata*; 14807 (6) *L. grandiflora*.

Bishop, Capt.

(38) *L. intermedia*.

Blankinship, L. A.

(5) *L. auriculata*.

Blankinship, J. W.

30, 659 (40a) *L. alpina* var. *spathulata*; 58 (40) *L. alpina*; (40) *L. alpina*; (24) *L. angustifolia*.

Bodin, J. E.

63 (18) *L. recurvata*.

Bogue, E. E.

(26) *L. gracilis*.

Brandege, T. S.

25 (33) *L. montana*; 345 (15) *L. Fendleri*; (38) *L. intermedia*.

Bray, W. L.

107, 285 (7) *L. densiflora*; 304 (12) *L. argyrea*.

Broadhead, G. C.

106 (33) *L. montana*.



- Buffum, B. C.  
 60 (33) *L. montana*; 61 (21) *L. argentea*; 66 (41a) *L. condensata* var. *laevis*.  
 Burk, W. H.  
 7 (11) *L. arctica*.  
 Bush, B. F.  
 186 (26) *L. gracilis*; 1152 (26a) *L. gracilis* var. *repanda*; 1170 (18) *L. recurvata*.  
 Butler, G. D.  
 1342 (50) *L. occidentalis*.  
 Canby, W. M.  
 18 (15) *L. Fendleri*; 21 (12) *L. argyraea*; 25 (18) *L. recurvata*.  
 Carleton, M. A.  
 214 (27) *L. Gordonii*.  
 Carr, W. P.  
 3 (22) *L. arenosa*.  
 Chandler, H. P.  
 1153 (50) *L. occidentalis*.  
 Churchill, J. R.  
 (33) *L. montana*.  
 Clemens, Mr. and Mrs. J.  
 807 (18) *L. recurvata*.  
 Clements, F. E.  
 2693 (21) *L. argentea*.  
 Clifton, R. L.  
 3023 (8) *L. Engelmannii*.  
 Coues, E. & Palmer, E.  
 188, 197, 237 (27) *L. Gordonii*.  
 Coville, F. V. & Funston, P.  
 406 (28) *L. Palmeri*; 2025 (44) *L. Kingii*.  
 Cowles, H. C.  
 62 (22) *L. arenosa*.  
 Crandall, C. S.  
 212 (33) *L. montana*.  
 Cusick, W.  
 2036, 2304, 3135, 3700 (49) *L. diversifolia*; 2054 (50) *L. occidentalis*; 2367 (51) *L. Cusickii*.  
 Dodda, G. S.  
 1839 (33) *L. montana*.  
 Dodge, C. K.  
 51 (2) *L. lasiocarpa*.  
 Doty, J.  
 166 (40) *L. montana*.  
 Drejer, S. T. N.  
 (11) *L. arctica*.  
 Eastwood, A.  
 8 (15) *L. Fendleri*.  
 Eggert, H.  
 (12) *L. argyraea*; (7) *L. densiflora*; (8) *L. Engelmannii*; (15) *L. Fendleri*; (27) *L. Gordonii*; (26) *L. gracilis*; (2) *L. lasiocarpa*; (9) *L. ovalifolia*; (18) *L. recurvata*.  
 Eggleston, W. W.  
 4419 (1) *L. Lescurii*; 5632, 11195, 17552 (33) *L. montana*; 7835, 7853, 8072 (40) *L. alpina*; 9030 (21) *L. argentea*.  
 Ellis, C. C.  
 7 (29) *L. pinetorum*.  
 Emig, W. H.  
 498 (9) *L. ovalifolia*.  
 Engelmann, G.  
 781 (26a) *L. gracilis* var. *repanda*; (21) *L. argentea*.  
 Engelmann, H.  
 30, 94 (46) *L. Wardii*.

- Fendler, A.  
 38, 23 (38) *L. intermedia*; 39, 40 (15) *L. Fendleri*.
- Fernald, M. L. & St. John, H.  
 216 (11a) *L. arctica* var. *Purshii*.
- Fernald, M. L. & Wiegand, K. M.  
 3465 (11a) *L. arctica* var. *Purshii*.
- Fiebig, K.  
 3034, 2619 (36) *L. mendocina*.
- Fisher, C. L.  
 104 (9) *L. ovalifolia*; 105 (15) *L. Fendleri*.
- Flodman, J. H.  
 497 (41a) *L. condensata* var. *laevis*.
- Garrett, A. O.  
 1344 (42) *L. Garrettii*; 1370 (47) *L. utahensis*.
- Gattinger, A.  
 (35) *L. globosa*; (1) *L. Lescurii*.
- Gleason, H. A.  
 (21) *L. argentea*.
- Goodding, L. N.  
 26, 56 (21) *L. argentea*; 61 (14) *L. purpurea*; 74, 2223 (15) *L. Fendleri*; 625 (45) *L. latifolia*; 1258 (47) *L. utahensis*; 2155, 2184 (28) *L. Palmeri*; (41a) *L. condensata* var. *laevis*.
- Gordon, A.  
 (27) *L. Gordonii*.
- Grant, G. B.  
 983 (38) *L. intermedia*.
- Greene, E. L.  
 902 (50) *L. occidentalis*; (27) *L. Gordonii*; (33) *L. montana*; (9) *L. ovalifolia*.
- Greenman, J. M., Jr. & Greenman, M. T.  
 91 (27) *L. Gordonii*.
- Gregg, J.  
 90, 292, 315 (12) *L. argyrea*; 91, 304 (15) *L. Fendleri*.
- Griffiths, D.  
 3493, 3531, 3548, 3905, 4011, 4091 (27) *L. Gordonii*; 3646, 4146 (14) *L. purpurea*; 4074, 4250 (15) *L. Fendleri*.
- Griffiths, D. & Cotton, J. S.  
 312 (52) *L. Douglasii*.
- Hall, E.  
 19 (7) *L. densiflora*; 20 (18) *L. recurvata*; 21 (8) *L. Engelmannii*; 22 (26) *L. gracilis*; 23 (6) *L. grandiflora*.
- Hall, E. & Harbour, J. P.  
 48 (21) *L. argentea*; 49 (33) *L. montana*.
- Hall, H. M.  
 5845, 5882 (28) *L. Palmeri*.
- Harris, J. A.  
 C142 (27) *L. Gordonii*; C1485 (14) *L. purpurea*.
- Hartman, C. V.  
 615 (15) *L. Fendleri*.
- Havard, V.  
 72 (15) *L. Fendleri*; (40a) *L. alpina* var. *spathulata*; (12) *L. argyrea*; (15) *L. Fendleri*; (2) *L. lasiocarpa*; (14) *L. purpurea*.
- Hayden, F. V.  
 88 (21) *L. argentea*; (40) *L. alpina*; (40a) *L. alpina* var. *spathulata*; (21) *L. argentea*; (41) *L. condensata*.
- Hayes, I. I.  
 10 (11) *L. arctica*.
- Heller, A. A.  
 1405 (2) *L. lasiocarpa*, in part; 1405 (2a) *L. lasiocarpa* var. *Berlandieri*, in part; 1478 (25) *L. Lindheimeri*; 1657 (18) *L. recurvata*; 10114 (46) *L. Wardii*.

- Heller, A. A. & Heller, E. G.  
3509 (33) *L. montana*; 3516 (38) *L. intermedia*; 3576 (15) *L. Fendleri*; 3634 (32) *L. rectipes*; (33) *L. montana*.
- Henderson, L. F.  
3885 (49) *L. diversifolia*.
- Herrick, C. L.  
204, 531 (29) *L. pinetorum*; 304 (14) *L. purpurea*; 537 (15) *L. Fendleri*.
- Hitchcock, A. S.  
16 (21) *L. argentea*; 24 (38) *L. intermedia*; 807, 848, 858 (44) *L. Kingii*; 1077 (9) *L. ovalifolia*; (38) *L. intermedia*; (9) *L. ovalifolia*.
- Hough, W.  
69 (15) *L. Fendleri*.
- Houghton, H. W.  
3573 (9) *L. ovalifolia*.
- Howell, A. H.  
332 (12) *L. argyrea*; 366 (6) *L. grandiflora*.
- Howell, T. J.  
(52) *L. Douglasii*; (50) *L. occidentalis*.
- Hubbard, G. W.  
185 (1) *L. Lescurii*.
- Jerny, G.  
(12) *L. argyrea*; (15) *L. Fendleri*; (26b) *L. gracilis* var. *sessilis*; (18) *L. recurvata*.
- Johnson, J. E.  
(28) *L. Palmeri*.
- Johnston, E. L.  
164 (21) *L. argentea*; 860 (33) *L. montana*; 976 (33a) *L. montana* var. *suffruticosa*.
- Jones, B. J.  
(40) *L. alpina*.
- Jones, M. E.  
19 (33) *L. montana*; 114, 5312e, 5338e, 5355a, 5388b, 5404, 5996c (38) *L. intermedia*; 1364, 5312d, 5375e, 5397b, 5441, 5958u, 6002e (47) *L. utahensis*; 3722 (14) *L. purpurea*; 3879, 5024e, 5029b (28) *L. Palmeri*; 4571 (39) *L. arisonica*; 5297a (21) *L. argentea*; 5302a (15) *L. Fendleri*; 5667c, 5684e, 5695b (46) *L. Wardii* (40a) *L. alpina* var. *spathulata*; (39a) *L. arisonica* var. *nudicaulis*; (21) *L. argentea*.
- Jones, W. W.  
(40) *L. alpina*.
- Joor, J. F.  
93, 95 (26) *L. gracilis*.
- Jørgensen, P.  
1062 (36) *L. mendocina*.
- Kelsey, F. D.  
92 (40) *L. alpina*.
- Kennedy, P. B.  
1096 (28) *L. Palmeri*.
- Kenoyer, L. A.  
(26a) *L. gracilis* var. *repanda*.
- Knowlton, F. H.  
94, 134 (21) *L. argentea*.
- Leiberg, J. B.  
130, 2337 (51) *L. Cusickii*; 5553 (38) *L. intermedia*; 5599 (43) *L. cinerea*.
- Lemmon, J. G.  
(14) *L. purpurea*.
- Lesquereux, L.  
(35) *L. globosa*; (1) *L. Lescurii*.
- Letterman, G. W.  
(27) *L. Gordonii*.
- Lewton, F. L.  
118 (26) *L. gracilis*.
- Lindheimer, F.  
8, 12, 330 (18) *L. recurvata*; 217 (5) *L. auriculata*; 299, 331, 668 (26) *L. gracilis*;

- 326, 301, 669 (26b) *L. gracilis* var. *sessilis*; 303, 329, 367, 666, 667, 670 (12) *L. argyraea*; 325, 421, 526, 576 (8) *L. Engelmannii*; 327 (25) *L. Lindheimeri*; 328, 577 (7) *L. densiflora*; (5) *L. auriculata*; (6) *L. grandiflora*.
- Lloyd, F. E.  
326 (15) *L. Fendleri*.
- Lundarr, A.  
(12) *L. arctica*.
- Lunnell, J.  
(22) *L. arenosa*; (52) *L. Douglasii*.
- Macbride, J. F. & Payson, E. B.  
952 (38) *L. intermedia*; 2897 (48) *L. prostrata*; 3770 (49) *L. diversifolia*.
- MacDougal, D. T.  
203 (38) *L. intermedia*; (38) *L. intermedia*.
- Macoun, J. M.  
10313, 10511 (40a) *L. alpina* var. *spathulata*; 12401 (22) *L. arenosa*; 70853 (52) *L. Douglasii*.
- Marsh, C. C.  
81 (32) *L. rectipes*.
- Marsh, C. D.  
(21) *L. argentea*.
- Maxon, W. R.  
3815 (6) *L. grandiflora*.
- Mearns, E. A.  
3 (15) *L. Fendleri*; 4 (14) *L. purpurea*; 5 (27) *L. Gordonii*; 1246, 1336 (12) *L. argyraea*.
- Mell, C. D.  
(21) *L. argentea*.
- Mell, C. D. & Knopf  
(21) *L. argentea*.
- Merrill, E. D. & Wilcox, E. N.  
521, 733 (21) *L. argentea*; 568 (23) *L. macrocarpa*.
- Metcalfe, J. K.  
48 (27) *L. Gordonii*.
- Metcalfe, O. B.  
23 (27) *L. Gordonii*; 1534 (29) *L. pinetorum*.
- Mohr, P. F.  
(27) *L. Gordonii*.
- Moodie, M. E.  
810 (22) *L. arenosa*.
- Mulford, A. I.  
614 (15) *L. Fendleri*.
- Nealley, G. C.  
121a, 268, 477 (14) *L. purpurea*; 147 (2) *L. lasiocarpa*; 148 (26) *L. gracilis*; 700, 701 (15) *L. Fendleri*.
- Nelson, A.  
59, 190, 1310, 3949, 7275, 8284 (21) *L. argentea*; 62, 1218, 4324, 6954, in part (41a) *L. condensata* var. *laevis*; 88, 1370, 3757, 7256, 8842 (33) *L. montana*; 2424 (34) *L. curvipes*; 3071 (41) *L. condensata*; 4564 (48) *L. prostrata*; 4676, 4797, 6954, 9002 (41) *L. condensata*, in part; 7081 (23) *L. macrocarpa*; 8553 (40a) *L. alpina* var. *spathulata*; (33) *L. montana*.
- Nelson, A. & Nelson, E.  
5423 (41a) *L. condensata* var. *laevis*; (34) *L. curvipes*.
- Nelson, E.  
265 (33) *L. montana*; 4854 (41a) *L. condensata* var. *laevis*.
- Nelson, E. W.  
3919 (15) *L. Fendleri*; 6631 (13) *L. Berlandieri*; 6771 (12) *L. argyraea*.
- Newton, Dr.  
(26a) *L. gracilis* var. *repanda*.
- Orcutt, C. R.  
1099 (28) *L. Palmeri*; 6106 (15) *L. Fendleri*; (12) *L. argyraea*.
- Osterhout, G. E.  
785, 3851, 4426, 4993, 5615, 5889 (33) *L. montana*; 786 (38) *L. intermedia*; 1102, 1103, 2621, 2864, 5888, 5914 (21) *L. argentea*; 1104, 3029, 3260 (40) *L.*

- alpina; 1947 (32) *L. rectipes*; 2050, 3965, 4412 (15) *L. Fendleri*; 4878 (9) *L. ovalifolia*; 6781 (33a) *L. montana* var. *suffruticosa*.
- Over, W. H.  
2005 (21) *L. argentea*; 2008 (40a) *L. alpina* var. *spathulata*; 6268 (22) *L. arenaea*.
- Oyster, J. H.  
(26a) *L. gracilis* var. *repanda*.
- Pace, L.  
44 (26) *L. gracilis*; 55 (18) *L. recurvata*; 210 (7) *L. densiflora*.
- Palmer, E.  
9, 38 (14) *L. purpurea*; 10 (27) *L. Gordonii*; 16 (39) *L. arizonica*; 29 (16) *L. Schaffneri*; 30, 182, 372, 464 (12) *L. argyrea*; 31, 182½, 277, 558 (15) *L. Fendleri*; 33, 41, 366 (2) *L. lasiocarpa*; 43 (39) *L. arizonica*; 670 (28) *L. Palmeri*; (21) *L. argentea*; (43) *L. cinerea*.
- Palmer, E. J.  
9121, 11219 (12) *L. argyrea*; 9136 (6) *L. grandiflora*; 9153, 10076, 11429 (7) *L. densiflora*; 9951 (18) *L. recurvata*; 11215, 11259 (2) *L. lasiocarpa*; 11479 (15) *L. Fendleri*; 11583, 11861 (18) *L. recurvata*; 11622 (26b) *L. gracilis* var. *sessilis*; 12526 (9) *L. ovalifolia*.
- Parish, W. F.  
(14) *L. purpurea*.
- Parry, C. C.  
(40) *L. alpina*.
- Parry, C. C., Bigelow, J. M., Wright, C. & Schott, A.  
42 (15) *L. Fendleri*; 43 (12) *L. argyrea*; 44 (27) *L. Gordonii*.
- Parry, C. C. & Palmer, E.  
25 (12) *L. argyrea*; 26 & 25½ (16) *L. Schaffneri*.
- Patterson, H. N.  
(40) *L. alpina*.
- Payson, E. B.  
294, 669 (32) *L. rectipes*; 1017 (33) *L. montana*; 1021 (15) *L. Fendleri*.
- Plank, E. N.  
(24) *L. angustifolia*.
- Plummer, F. G.  
(31) *L. lata*.
- Popenoe, E. A.  
(15) *L. Fendleri*.
- Porsild, M. P.  
(11) *L. arctica*.
- Porter, T. C.  
(21) *L. argentea*; (1) *L. Lescurii*.
- Pringle, C. G.  
176 (15) *L. Fendleri*; 949 (14) *L. purpurea*; 6899 (3) *L. Schaueriana*; 9182 (12) *L. argyrea*; 10236 (2) *L. lasiocarpa*; (27) *L. Gordonii*; (14) *L. purpurea*.
- Purpus, C. A.  
1024, 4920 (12) *L. argyrea*; 1025, 4926 (15) *L. Fendleri*; 1148, 5232 (16) *L. Schaffneri*; 3389 (17) *L. pueblensis*; 5863 (44) *L. Kingii*; 7096 (38) *L. intermedia*; (38) *L. intermedia*.
- Ramaley, F.  
710, 1027 (33) *L. montana*.
- Reverchon, J.  
40, 2970 (26) *L. gracilis*; 42 (26b) *L. gracilis* var. *sessilis*; 1439, 3718 (12) *L. argyrea*; 2967, 3717 (5) *L. auriculata*; 3716 (26a) *L. gracilis* var. *repanda*; 3719 (2) *L. lasiocarpa*; 4288 (27) *L. Gordonii*; (12) *L. argyrea*; (5) *L. auriculata*; (7) *L. densiflora*; (8) *L. Engelmannii*; (15) *L. Fendleri*; (27) *L. Gordonii*; (26) *L. gracilis*; (6b) *L. gracilis* var. *sessilis*; (6) *L. grandiflora*; (9) *L. ovalifolia*; (18) *L. recurvata*.
- Rose, J. N.  
42 (34) *L. curvipes*; 11652, 11692 (14) *L. purpurea*; 11740 (27) *L. Gordonii*; 12111 (38) *L. intermedia*.
- Rose, J. N. & Fitch, W. R.  
17908 (15) *L. Fendleri*.

- Rose, J. N. & Painter, J. H.  
6430 (15) *L. Fendleri*.
- Rose, J. N., Painter, J. H. & Rose, J. S.  
8350, 8815, 8901 (3) *L. Schaueriana*; 10027 (17) *L. pueblensis*.
- Rusby, H. H.  
14, 398 (27) *L. Gordonii*; 15 (14) *L. purpurea*; 16 (15) *L. Fendleri*; 514½ (39) *L. arizonica*.
- Russell, C.  
(26) *L. gracilis*.
- Ruth, A.  
5 (9) *L. ovalifolia*; 39 (26) *L. gracilis*.
- Rutter, C.  
(21) *L. argentea*.
- Rydberg, P. A.  
22 (9) *L. ovalifolia*; 533 (22) *L. arenosa*; 1281 (21) *L. argentea*; (21) *L. argentea*.
- Rydberg, P. A. & Bessey, E. A.  
4169 (40a) *L. alpina* var. *spathulata*; 4170 (40) *L. alpina*.
- Rydberg, P. A. & Carlton, E. C.  
6411, 7160 (47) *L. utahensis*.
- Rydberg, P. A. & Garrett, A. O.  
8553, 9448 (32) *L. rectipes*.
- Rydberg, P. A. & Vreeland, F. K.  
6137, 6139, 6141, 6145 (33) *L. montana*; 6142 (9) *L. ovalifolia*; 5143 (15) *L. Fendleri*.
- Ryder, C.  
(11) *L. arctica*.
- Safford, W. E.  
1261 (15) *L. Fendleri*.
- Sandberg, J. H. & Leiberg, J. B.  
426 (52) *L. Douglasii*.
- Sarvis, J. T.  
6 (21) *L. argentea*.
- Schaffner, J. G.  
555 (16) *L. Schaffneri*.
- Schneck.  
(33) *L. montana*.
- Sharp, S. S.  
339 (34) *L. curvipes*.
- Shear, C. L.  
4369 (41) *L. condensata*.
- Shuttleworth, E. A.  
(38) *L. intermedia*.
- Shepherd, T. M.  
(27) *L. Gordonii*; (9) *L. ovalifolia*.
- Skehan, J.  
3 (15) *L. Fendleri*; (27) *L. Gordonii*.
- Smith, C. P.  
2248, 2244 (47) *L. utahensis*.
- Sonne, C. F.  
23 (50) *L. occidentalis*.
- Standley, P. C.  
6054 (33) *L. montana*; 6249, 6294 (33a) *L. montana* var. *suffruticosa*; 7087 (32) *L. rectipes*; 7091 (15) *L. Fendleri*; (27) *L. Gordonii*; (14) *L. purpurea*.
- Stanton, E. M.  
(21) *L. argentea*.
- Stearns, E.  
137 (14) *L. purpurea*.
- Stein, R.  
170, 174 (11) *L. arctica*.
- Stevens, G. W.  
36, 348 (9) *L. ovalifolia*; 88 (26a) *L. gracilis* var. *repanda*; 188 (5) *L. auriculata*.



- Sukedorf, W. N.  
842 (52) *L. Douglasii*.
- Swift, Dr.  
(7) *L. densiflora*.
- Thornber, J. G.  
369 (27) *L. Gordonii*.
- Tidestrom, I.  
203, 1322 (47) *L. utahensis*; 825 (43) *L. cinerea*, in part; 827 (14) *L. purpurea*;  
909, 964 (38) *L. intermedia*; 2176 (21) *L. argentea*.
- Toumey, J. W.  
65 (43) *L. cinerea*; 66 (27) *L. Gordonii*; (27) *L. Gordonii*.
- Tracy, S. M.  
8043 (27) *L. Gordonii*; 8044 (15) *L. Fendleri*; 9193 (6) *L. grandiflora*; 9196  
(26) *L. gracilis*; 9348 (2a) *L. lasiocarpa* var. *Berlandieri*.
- Tracy, S. M. & Earle, F. S.  
31 (15) *L. Fendleri*; 119 (27) *L. Gordonii*; 143, 338 (15) *L. Fendleri*.
- Trelease, W.  
22 (12) *L. argyrea*; (12) *L. argyrea*; (26a) *L. gracilis* var. *repanda*; (18) *L. recurvata*.
- Tweedy, F.  
147 (33a) *L. montana* var. *suffruticosa*; 3587 (40a) *L. alpina* var. *spathulata*;  
3588 (34) *L. curvipes*; 4489 (21) *L. argentea*; 5067 (33) *L. montana*; (27) *L. Gordonii*.
- Umbach, L. M.  
85 (40a) *L. alpina* var. *spathulata*.
- Vasey, G. R.  
47 (21) *L. argentea*; 188 (52) *L. Douglasii*; (15) *L. Fendleri*; (27) *L. Gordonii*;  
(14) *L. purpurea*.
- Visher, S. S.  
176 (21) *L. argentea*; 444 (40a) *L. alpina* var. *spathulata*; 571 (22) *L. arenosa*.
- Waldron, C.  
128 (22) *L. arenosa*.
- Walker, E. P.  
150, 168 (32) *L. rectipes*.
- Ward, L. F.  
418 (38) *L. intermedia*; 589 (46) *L. Wardii*; (15) *L. Fendleri*; (38) *L. intermedia*.
- Watson, S.  
32 (41a) *L. condensata* var. *laevis*; 82 (44) *L. Kingii*.
- Webber, H. C.  
(40a) *L. alpina* var. *spathulata*; (21) *L. argentea*.
- Weller, S.  
(40a) *L. alpina* var. *spathulata*.
- White, M.  
140 (27) *L. Gordonii*.
- Whited, K.  
1065, 1119, 1247, 2606 (52) *L. Douglasii*.
- Williams, T. A.  
46, 333 (21) *L. argentea*; (21) *L. argentea*.
- Willits, V.  
94 (34) *L. curvipes*.
- Wilkes' Expedition.  
857 (52) *L. Douglasii*.
- Wilkinson, E. H.  
101 (18) *L. recurvata*; (14) *L. purpurea*.
- Wolfe, J.  
641 (33) *L. montana*; (21) *L. argentea*.
- Woods, C. N.  
56a (49) *L. diversifolia*.
- Woods, C. N. & Tidestrom, I.  
2728 (49) *L. diversifolia*.
- Wootton, E. O.  
155 (15) *L. Fendleri*; 245 (20) *L. aurea*; (20) *L. aurea*; (15) *L. Fendleri*; (7)

- L. Gordonii*; (31) *L. lata*; (28) *L. Palmeri*; (29) *L. pinetorum*; (14) *L. purpurea*; (32) *L. rectipes*.  
Wooton, E. O. & Standley, P. C.  
3460 (29) *L. pinetorum*; (15) *L. Fendleri*; (27) *L. Gordonii*.  
Wright, C.  
16, 849 (12) *L. argyrea*; 16, 850, 851, 852, 1319 (15) *L. Fendleri*; 848 (26) *L. gracilis*; 1318 (17) *L. Gordonii*; 1320 (14) *L. purpurea*; (5) *L. auriculata*.  
York, H. H.  
385 (26) *L. gracilis*.  
Young, M. S.  
28 (6) *L. grandiflora*; 96 (14) *L. purpurea*; (8) *L. Engelmannii*.  
Zuck, M.  
(15) *L. Fendleri*; (14) *L. purpurea*.

